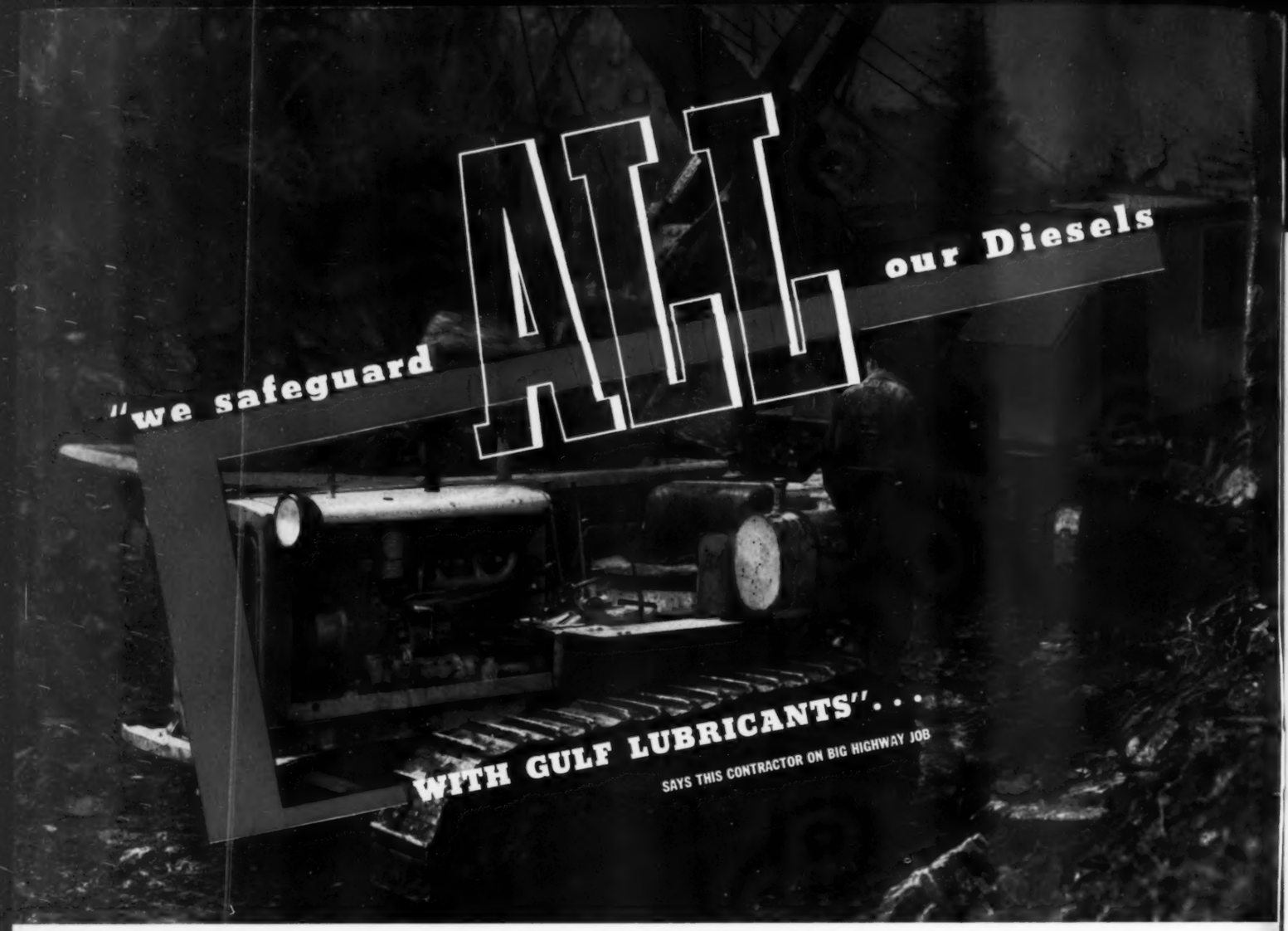
JULY, 1937 CIRCULATION OF THIS ISSUE—IN EXCESS OF 11,000 COPIES 25c

# DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR




**Whether in shovels or in tractors, Diesels perform better when the proper lubricants are used**

"IT has paid us to use the oils recommended by the Gulf engineer for our Diesel engines," says this contractor. "We don't have to worry about operating troubles—our equipment keeps moving dirt."

In Gulf's line of quality Diesel oils are lubricants which are exactly suited to the type of Diesels you operate. More than 50 of America's foremost Diesel engine builders have approved Gulf oils for the engines they build. That is significant—for it means that the builder considers his engines are receiving full protection against wear and repair expense when Gulf lubricants are used.

Without obligating yourself in any way, you can have a Gulf engineer look over your equipment and recommend the lubricants which will be most efficient and economical in service. He is familiar with all types of Diesels and is prepared to extend this service to you.

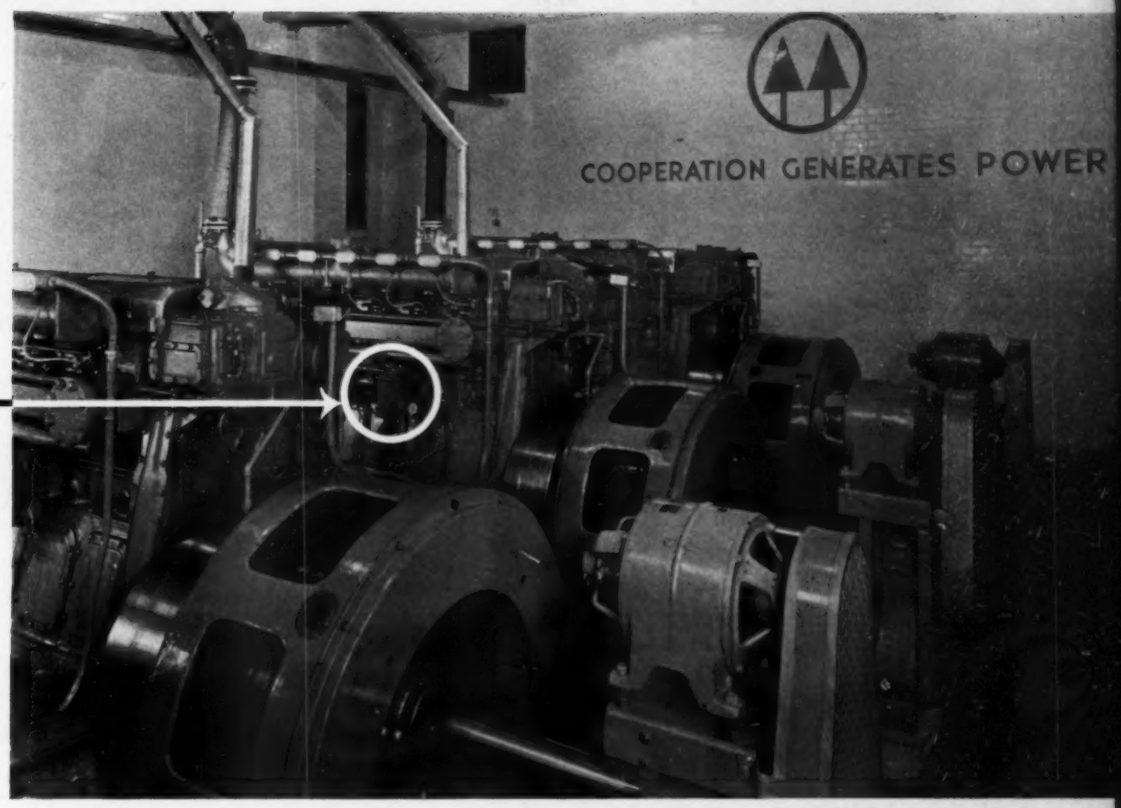
**GULF OIL CORPORATION** — **GULF REFINING COMPANY**

GULF INDUSTRIAL LUBRICATION

MAKERS OF GULF NO-NOX ETHYL GASOLINE AND GULFPRIDE OIL

DIESEL PROGRESS for July, 1937. Volume III. No. 7. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Possessions $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U. S. A., 50 cents for all other countries.

# · DIESEL FILTERS ·



## Sentinel Filters Guard Cooper-Bessemer Diesels

AT

## AMALGAMATED HOUSING

ALL three six-cylinder, 160 h.p. Cooper-Bessemer Diesel engines at the Amalgamated Housing installation, Van Cortlandt Park, New York City, are individually protected by Sentinel Fuel Oil Filters. These Diesel oil filtering units positively remove 100 per cent of any water from either fuel or lubricating oils. In addition to permitting the use of heavier and more powerful Diesel fuels which prolong the life of the injection system, they eliminate costly trouble arising from dirty fuel oil clogging the spray nozzles. Sentinel Diesel Oil Filters operate on a clearance of 1/10,000 of an inch with a high efficiency up to 1/50,000 of an inch. They contain no moving parts, are easily installed and require no additional pumps. Since they are cleaned by compressed air from the starting tanks, no dismantling for cleaning is ever necessary.

***Guard Your Diesel with a Sentinel Oil Filter***

**DEALERS**

O. Smith Johannsen
50 Church Street,
New York, N. Y.

Hathaway Machinery Co.
New Bedford, Mass.

D. L. MacQuarrie
410 No. Alfred Street
Los Angeles, Calif.

Captain W. J. Moloney
404 Colman Bldg.
Seattle, Wn.

**DIESEL FILTER CO.**

(INCORPORATED)

MANUFACTURERS

**SENTINEL**

OIL FILTERS

ASTORIA, OREGON

**DEALERS**

Diesel Plant Specialties Co.
149 West Hubbard Street,
Chicago, Ill.

W. L. Kimbrough
Hobbs, New Mexico

Western Sales Co.
200 Davis Street
San Francisco, Calif.

Burrard Iron Works Ltd.
231-235 Alexander St.
Vancouver, B.C.

# En-ar-co DIESEL OILS

## PAY THEIR OWN WAY!

***At the Sign of the Boy and Slate There Is an En-ar-co Lubricant for Every Requirement***

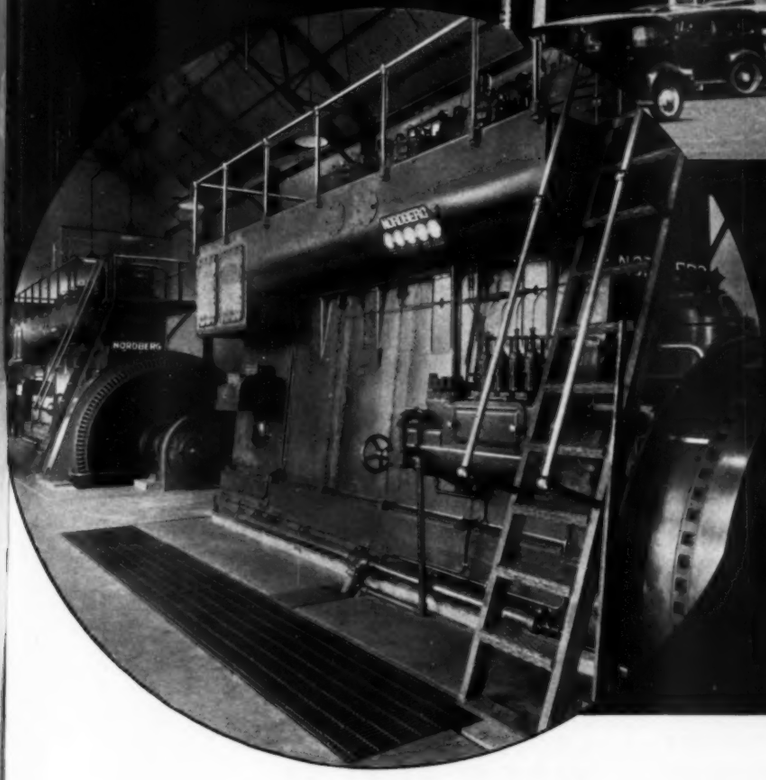
Owners and operators of Diesel Engine Equipment, both large and small, have proved the economy of En-ar-co Lubrication.

In many cases, the money saved through extra hours of uninterrupted service, the avoidance of shutdowns, and the elimination of preventable repairs has more than paid the lubrication bill.

Don't take chances when so large an investment is at stake. Don't gamble a few lubrication dollars against the investment in your Diesel Engines.

En-ar-co Lubrication is always safe lubrication.

**THE NATIONAL REFINING COMPANY**
**HANNA BUILDING • • • CLEVELAND, OHIO**




# *Another and Larger* NORDBERG DIESEL *for the city of Greenville, Texas*

TO meet the need for additional generating capacity, the City of Greenville, Texas, has just purchased another and larger Nordberg Diesel of 2000 bhp. This new unit is again of the two-cycle type with mechanical injection of the fuel. Two Nordbergs of the same type have been in almost continuous operation in this plant for about four years, one unit being of 750 bhp. and the other of 1450 bhp. These two smaller Diesels have served the city faithfully, and in fact, according to the A.S.M.E. Power Cost Reports, charges for fuel, lubricating oil and repairs are among the lowest on record.

Freedom from operating difficulties, low maintenance and low generating costs experienced over four years of actual operation by the City of Greenville, led to the selection of this larger Nordberg of 2000 bhp. Here again is evidence of good performance and high quality built into Nordberg Diesels.

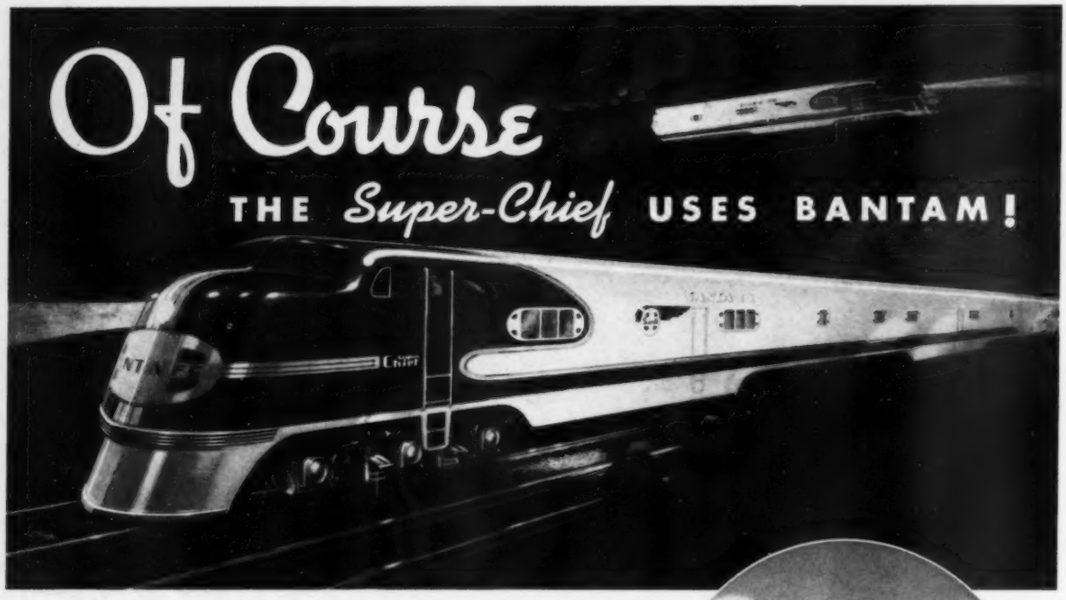
**Nordberg Diesels are available in two and four-cycle types, from 150 bhp. upwards.**

## NORDBERG MFG CO., MILWAUKEE

| NEW YORK | WASHINGTON | CLEVELAND | KANSAS CITY | DALLAS | LOS ANGELES |
|---|---|---|---|---|---|
| 60 E 42nd St. | Barr Bldg. | 318 Rockefeller Bldg. | 3560 Broadway | 3801 Potomac Ave. | Subway Terminal Bldg. |

# Of Course

## THE *Super-Chief* USES BANTAM!



Four 900 H.P. Winton Diesel Engines driving the Super Chief are equipped with Bantam Wrist Pin Bearings

THE performance records of Bantam Wrist Pin Bearings on Diesel Powered trains have been so impressive that it seemed only logical that they should be chosen for the Super-Chief.

Bantam was a pioneer in the development of wrist pin bearings for this purpose. Bantam Bearing quality is the natural result of this leadership.

When you need bearings, profit by the experience of the nation's leading railroads. Use Bantam Bearings.

**BANTAM BEARINGS CORPORATION**
SOUTH BEND, INDIANA
Subsidiary of THE TORRINGTON COMPANY
Torrington, Conn.

**BANTAM BEARINGS**

**FAMOUS USERS OF BANTAM BEARINGS**

●

BURLINGTON

ILLINOIS CENTRAL

UNION PACIFIC

SANTA FE

BALTIMORE & OHIO

BOSTON & MAINE

TAPERED ROLLER · · · STRAIGHT ROLLER · · · BALL BEARINGS

# "HE'S DOWN IN THE PLANT TODAY"

## More Than Ever Before Top Executives Are Back Scrutinizing Every Plant Operation

*Finding Out:*

1 WHY power costs so much.

2 HOW to cut down your annual maintenance costs.

3 WHERE to speed up daily production schedules.

4 WHAT will lower oil costs.

THE "BIG BOSS" takes his experience back into the plant today...because the keenest industrial minds in America recognize the need for more know-how, more knowledge of machines...more skilled workers.

For 71 years the makers of Gargoyle Lubricants have been helping the men who own plants...the men who run them. This experience—the greatest in the oil business—can be put to work in your plant...increasing manufacturing profits.

Take a Socony-Vacuum Engineer into your confidence. Let him discuss a program of planned "Correct Lubrication" with your capable plant men...those who know your individual operating problems best. Together, they may be able to devise ways and means of gaining more efficient production.

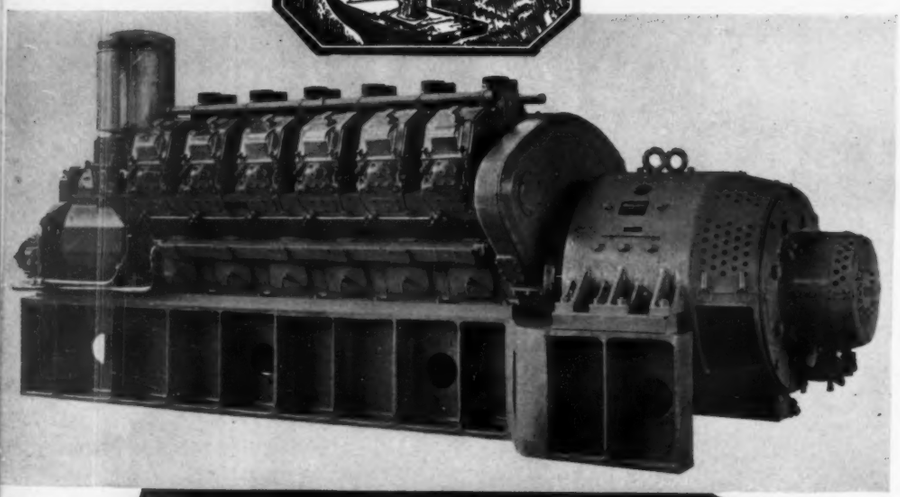
**SOCONY-VACUUM**
**INDUSTRIAL LUBRICATION**

GARGOYLE Lubricants

**SAVES MONEY FOR INDUSTRY**

71 Years' Lubricating Experience...the Greatest in the Oil Business

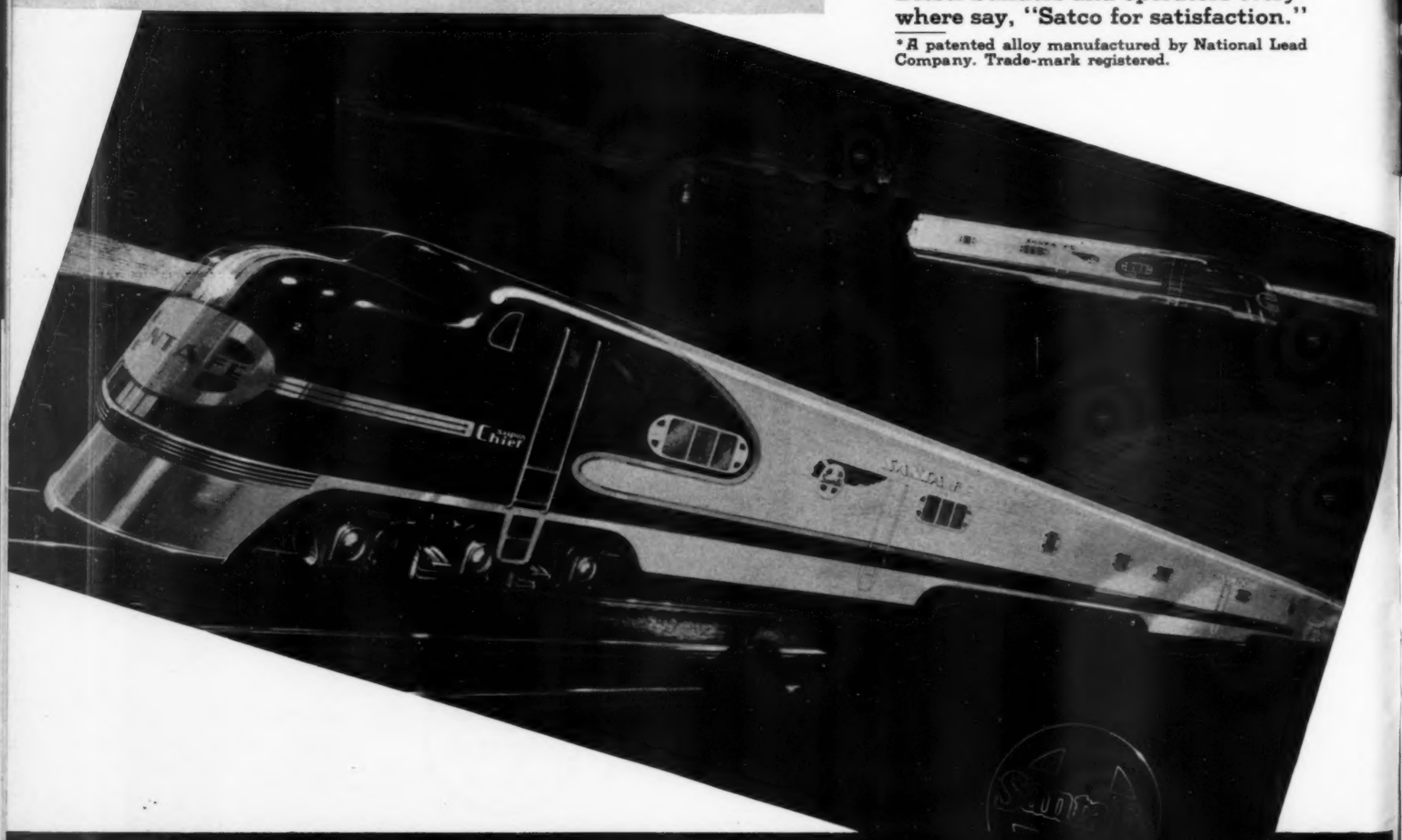
# "Let's Watch The Chief Go Thru!"



THOUSANDS of people in the towns on the Sante Fe between Chicago and Los Angeles gather regularly at trackside just for the thrill of watching the Super Chief "go thru". For a few fast seconds, these people see the outward evidence of progress in rail transportation—the streamlined form, the modern color treatment. What the spectators don't see is hidden "under the hood"—the four 900 hp. Diesels that enable the Super Chief to cover the 2225 mile route in 39¾ hours.

The bearing linings in these engines are Satco* metal. This modern alloy is no stranger to the Diesel field. It has been put to the test repeatedly and has always delivered. Diesel builders and operators everywhere say, "Satco for satisfaction."

*A patented alloy manufactured by National Lead Company. Trade-mark registered.




## AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS — INDIANA

CENTRIFUGAL American Bearings FORCE

*The "Caterpillar" Diesel doing this bulldozing job is lubricated with Sinclair Ten-ol.*

# for HEAVIEST WORK .. LEAST WEAR

## and 10 times more Diesel Service Hours

# SINCLAIR TEN-OL

Reg. U. S. Pat. Off.

**Wouldn't you like to keep your "Caterpillar" Diesel engine or tractor giving top-notch performance through many thousands of hours at lowest possible upkeep cost?**

**You can by using Ten-ol, the new, fused lubricant developed by Sinclair for "Caterpillar" Diesels.**

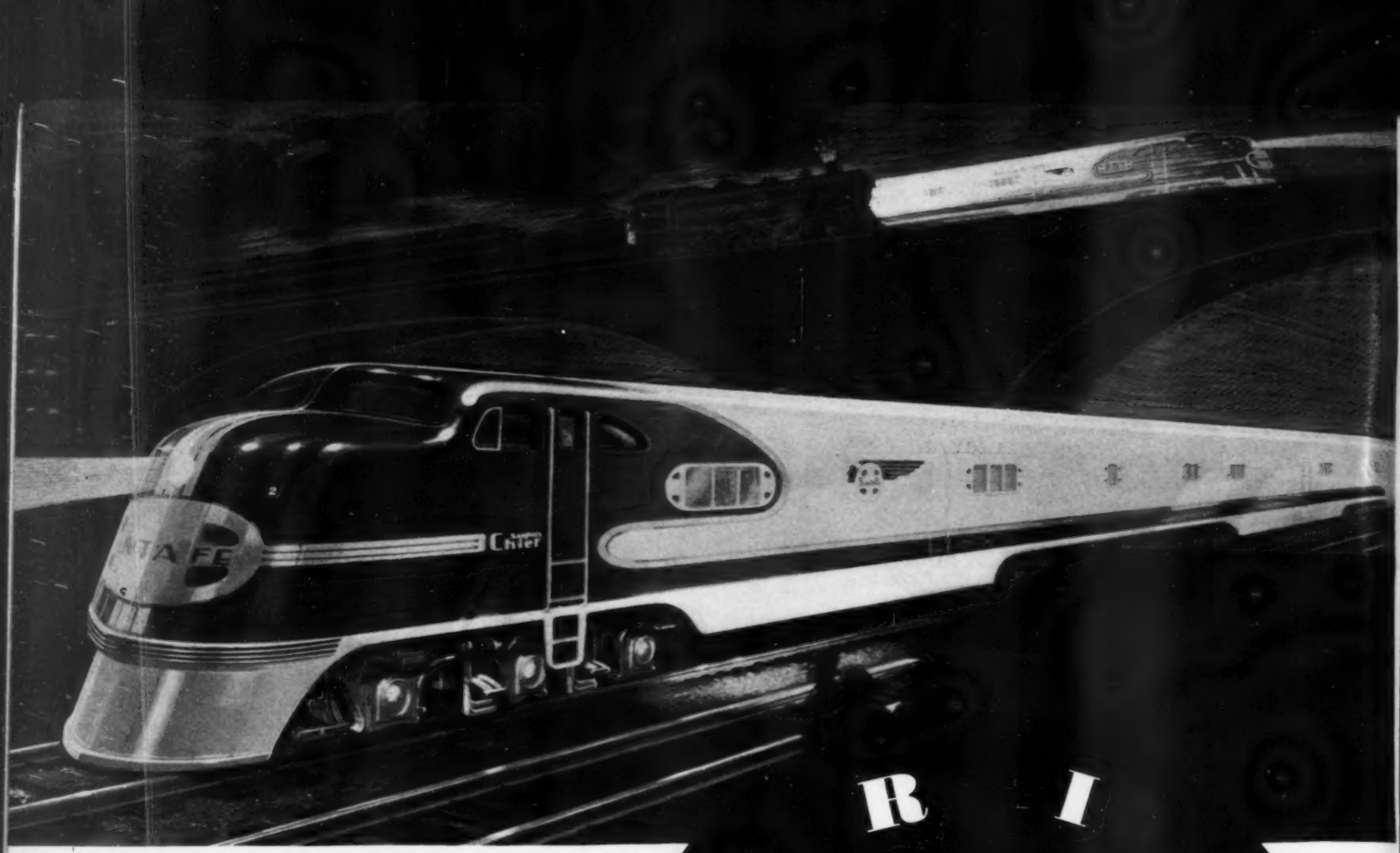
**Here's the proof. In laboratory tests with "Caterpillar" Diesel engines, more punishing than any service duty, and also in actual field operation, Ten-ol demonstrated that it gives ten times more service hours than the finest straight mineral oil.**

**In 2000-hour heavy-duty, high-output wear tests, "Caterpillar" Diesels, lubricated with Ten-ol showed less than 1/10 the cylinder liner wear shown by similar engines lubricated with the finest "straight" oil.**

**Order Sinclair Ten-ol, Sinclair Diesel fuel and other Sinclair products from your local Sinclair office, or write Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.**

*Copyrighted 1937 by Sinclair Refining Company (Inc.)*

**Sinclair TEN-OL is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.**

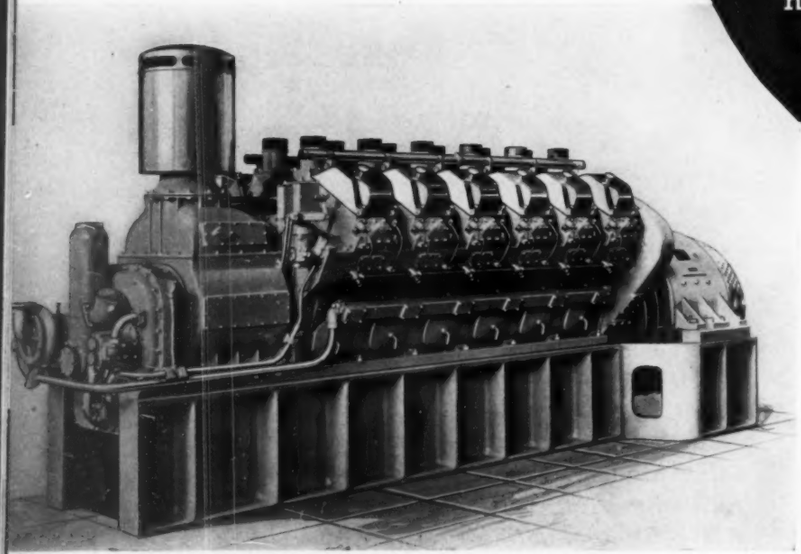


E R I E

Many other Diesel engine builders rely upon Erie crankshafts and other forgings because of superior quality and accurate finish.

All high-speed Diesel trains now in service and equipped with Winton engines have Erie crankshafts.

**WE ALSO MAKE** rough and finished connecting rods, piston rods, crossheads, generator and extension shafts.



**ERIE FORGE COMPANY**

**ERIE**

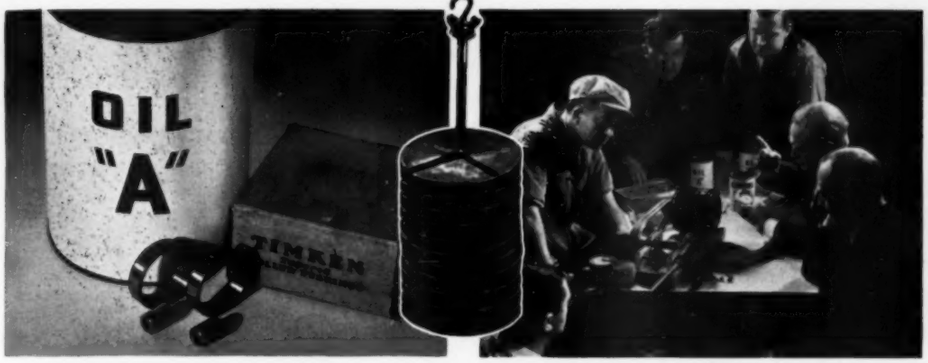
**PENNSYLVANIA**

# WHAT DO YOU MEAN *That Oil Stands Up?"*

**RING-FREE TEST NO. 1**

One of a series of "make-your-own-tests" pioneered by Macmillan, requires the use of the laboratory film-strength testing machine pictured.

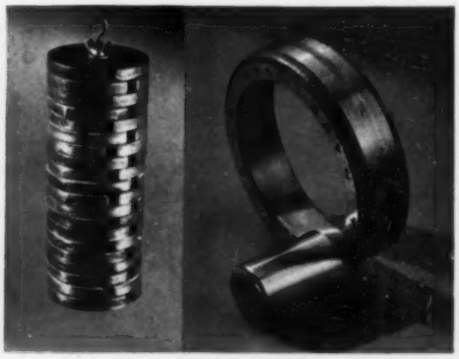
**"Doesn't break down during every day use or even under extreme emergency conditions" is what most people mean when they say, "That Oil Stands up!" Generally speaking, the oil with the toughest film-strength "stands up" better than other oils. And here is a quick easy way to accurately measure the comparative film-strength of motor oils.**




First, take a sample of your favorite motor oil . . . the oil you consider "the finest oil made," and test it on this machine. Parts of Timken Roller Bearings are used to provide uniform metal strength. Rotating in a bath of oil, one of these bearings, revolves against another, which is held in a stationary position to create a friction surface. Friction pressure is increased by adding weights to the lever arm. One pound weights added each minute increases the pressure at the ratio of 800 pounds per square inch. When this pressure becomes great enough to break the oil film, metal-to-metal contact occurs and rapid wear and metal seizure results. The average oil breaks down under only a few weights added with resultant wear pictured above.

Then, clean the testing machine thoroughly and repeat the test, this time using the same S.A.E. grade of Macmillan RING-FREE Motor Oil and new bearing parts. One weight each minute exactly as before. The result will surprise you.

Twenty weights or more will not break the film of RING-FREE because this motor oil is double-distilled to a purity of grade unmatched by other oils. Because RING-FREE lubricates better even under conditions of extreme pressure you will see by the results of this test that wear has been held to a minimum. You will also see that RING-FREE has an extra margin of film-strength more than sufficient to protect your motor even under abnormal conditions.



**Here is the accurate answer to "How well any oil stands up". Here is the way to get direct comparative evidence of the film-strength of any motor oil. This remarkable machine also demonstrates, visually, RING-FREE Motor Oil's extremely high resistance to heat and its ability to cling to rapidly revolving parts so that a protective film of pressure-resisting oil is carried to the friction surfaces. The Macmillan Man in your area has this film-strength testing machine waiting for you to make these comparative tests for yourself. This machine will tell you more about motor oil film-strength than all the words in the world.**

**MACMILLAN PETROLEUM CORPORATION, 530 W. 6th St., Los Angeles**
**50 West 50th Street, New York City, and El Dorado, Arkansas**

**MACMILLAN**
**RING-FREE**
**MOTOR OIL**

1. GREATER FILM STRENGTH
2. HIGHER HEAT RESISTANCE
3. LONGER CLING TO METAL
4. FASTER PENETRATION
5. REMOVES HARD CARBON
6. IS NOT CORROSIVE

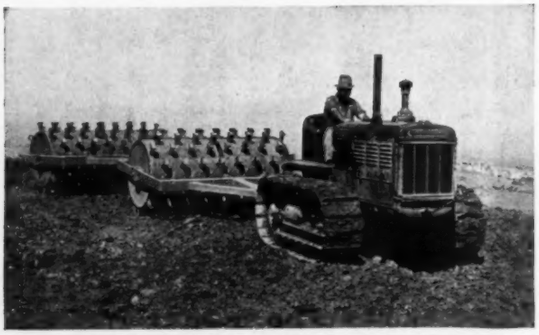
# Specify the INTERNATIONAL Diesel TracTracTor to Handle the Tough Work at Low Cost

Six International TracTracTors were used in the construction of the new $3,000,000 Portland, Ore., airport. This shows one of the Diesel-powered TracTracTors pulling a 6-yard scraper. Other units did the bulldozing. Two million yards of dirt were moved by these Internationals in leveling operations.

This International Diesel TracTracTor is grading streets in the 4500-acre subdivision under way in West Vancouver, B. C., Canada, by British Pacific Properties, Ltd.

A typical Diesel-powered sleigh train, moving mine supplies through the snow on Lac Seul, near Hudson, Ont., Canada, last winter. R. W. Starratt, owner of this International Diesel TracTracTor, is one of many freighters who successfully fight snow and cold every winter to keep Canada's mines outfitted.

THE many advantages of International Diesel engine operation are available to users of crawler power in the International TD-40 TracTracTor. Here Diesel power is combined with the famous TracTracTor design to provide outstanding heavy-duty performance at low operating cost.



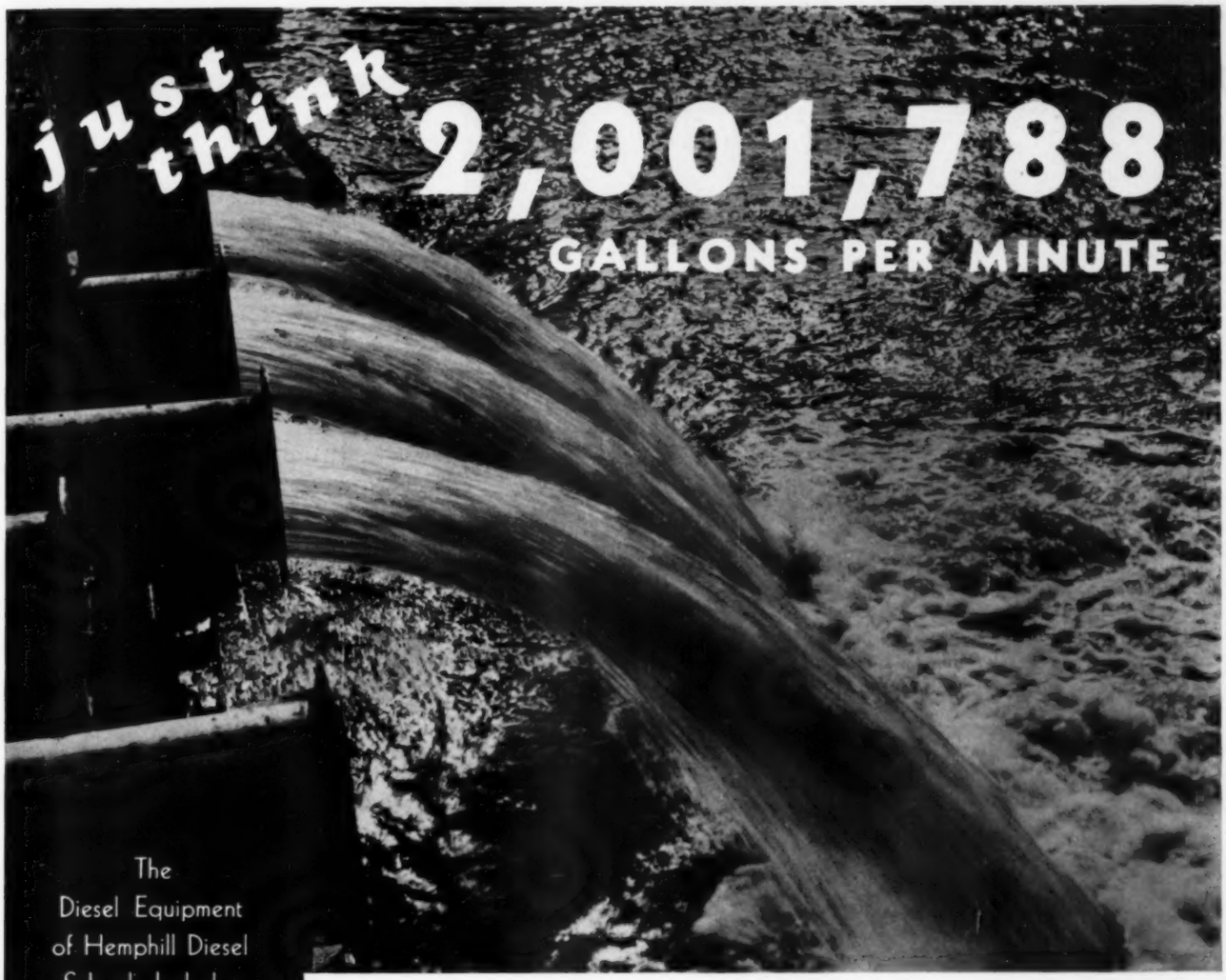
An International Diesel TracTracTor pulling sheeps-foot rollers to compact the earth fill on the 90,000,000-gallon Sunset Reservoir project on the outskirts of San Francisco, just beyond the new Golden Gate Bridge.

The International Diesel engine is characterized by its remarkable ease of starting and quick conversion to Diesel fuel. It can be cranked and started as readily as a gasoline engine of corresponding size and it shifts automatically to Diesel operation.

Investigate the International TD-40 TracTracTor. Ask the nearby Company-owned branch or industrial dealer for information. This Diesel engine is also available in the International WD-40 Wheel Tractor and as a power unit. There also is a 6-cylinder Diesel Power Unit in the International line.

INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
606 So. Michigan Ave. Chicago, Illinois

# INTERNATIONAL Industrial Power




The Diesel Equipment of Hemphill Diesel Schools Includes Engines for

TRAINS
CARS
TRACTORS
BUSES
PLANES
SHIPS
TRUCKS
FARMS
YACHTS
PUMPING
MINING
GENERATING
UTILITIES
TUGS
OIL FIELDS
DREDGES

**The Diesel engines in the Hemphill Diesel Schools, operating together, could pump 2,001,788 gallons of water per minute. Forty-six American and foreign makes comprise the largest number and widest range of Diesel units for instruction purposes in the world. Hemphill students also receive training on fuel injection systems and laboratory testing equipment second to none.**

Backed up by this unsurpassed practical shop training is a course of study in Diesel theory and principles that is the product of years of study and research by outstanding Diesel engineers. Thousands of miles of travel have gone to fine-combing the vast international store of accumulated knowledge in the Diesel field.

Hundreds of Hemphill graduates are holding positions of responsibility in Diesel work, and we continue to challenge Diesel engine owners, users, and builders to put our recommended graduates to the test.

# HEMPHILL DIESEL SCHOOLS

**A nation-wide institution serving the Diesel industry from the following great centers of Diesel activity:**

**BOSTON** . . . . . 110 Brookline Avenue
**NEW YORK** . . 31-28 Queens Blvd., L. I. C.
**DETROIT** . . . . 2340 W. Lafayette Boulevard
**CHICAGO** . . . . . 2020 Larrabee Street
**MEMPHIS** . . . . . 421 Monroe Avenue
**LOS ANGELES** . . . 2121 San Fernando Road
**SEATTLE** . . . . . 503 Westlake North
**VANCOUVER, B. C.** . . . 1365 Granville Street

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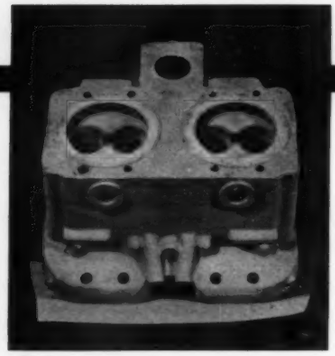


# . . . for better Diesel engine performance

The higher speed Diesel engines, particularly, need the advantages of Aluminum cylinder heads. There is sufficient experience to justify the statement that Aluminum cylinder heads make the engine perform better, require less attention, go longer without an overhaul. The reason is superior heat conductivity.

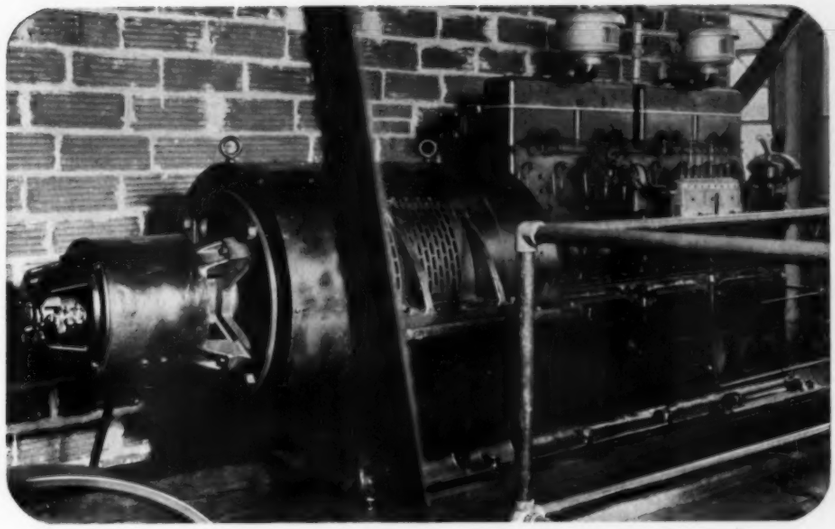
Even distribution of heat throughout the mass of the cylinder head eliminates the severe internal stresses which so often cause cylinder heads to break. Better heat distribution also means cooler valve seats, and longer valve life. To Aluminum cylinder heads must be credited considerable reduction in valve maintenance.

The uniform temperatures of Aluminum cylinder heads tend to reduce the deposit of scale from cooling water.

The light weight of the Aluminum cylinder head is an important factor in facilitating maintenance and inspection on large engines, and in reducing dead weight of Diesels for transportation and other services, where over-all weight is important. Aluminum Company of America, 2141 Gulf Building, Pittsburgh, Pennsylvania.

*Be sure* . . . CYLINDER HEADS ARE

ALCOA · ALUMINUM



*Superior*

**Model GA-8 with 60 KW Alternating Current Generator installed in the Keystone Lamp Manufacturing Company's plant at Slatington, Penna.**

**WHEN the Keystone Lamp Manufacturing Company decided to reduce operating costs it was found that electric power bills represented a large item of expense and that a Diesel engine would show very attractive savings.**

**A simple and reliable source of power was essential as the entire operation of the plant depended upon an unfailing supply of electric service for motors and lights.**

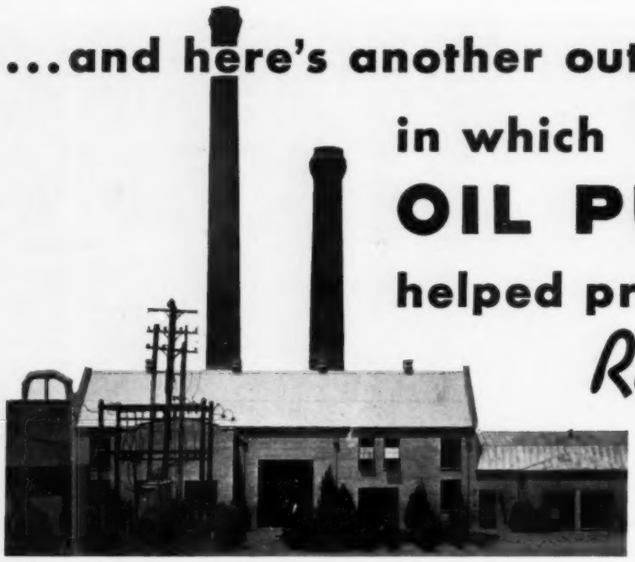
**The record of reliability, low operation and maintenance costs and the simple and rugged design of the Superior Diesel Engine made it the logical selection for this rigid requirement.**

**THE NATIONAL SUPPLY COMPANY**
OF DELAWARE
SUPERIOR ENGINE DIVISION
LOS ANGELES, CALIFORNIA SPRINGFIELD, OHIO PHILADELPHIA, PA

# Superior DIESELS

**HEAVY DUTY MODELS: 50 to 810 H.P., 250 to 720 R.P.M. • HIGH SPEED MODELS: 25 to 150 H.P., 1200 to 1800 R.P.M.**

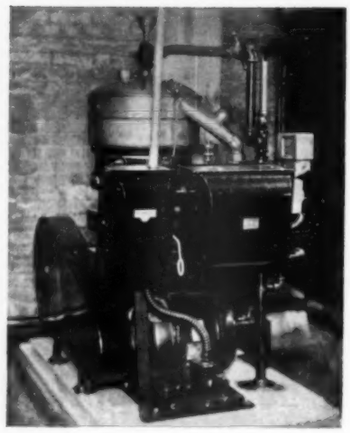
# ...and here's another outstanding Diesel plant in which DE LAVAL OIL PURIFIERS have helped promote *Remarkable Economy and Efficiency*

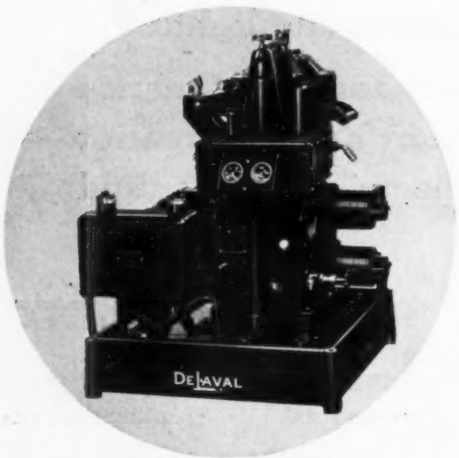


FOR nearly four years two De Laval Oil Purifiers have served with clean lubricating and fuel oil the Diesel engines installed in the municipal power plant at Greenville, Texas. They have aided in no small way in keeping repair and maintenance cost at a minimum—to say nothing of the economy effected in the use of lubricating oil.

For many years it has been true that outstanding power plants of all types almost invariably include De Laval Oil Purifiers among their auxiliary equipment. Low repair and maintenance costs are almost impossible of achievement except with efficient lubrication—and no oil can lubricate properly unless it is clean.

De Laval Oil Purifiers are selected for outstanding plants—or for those which later become outstanding—because of their well-known ability to more completely remove carbon, sludge and water from the lubricating system and so keep the oil in the cleanest and most efficient condition possible.






The De Laval "Uni-Matic" Oil Purifier is a complete oil purification plant

Purification of fuel oil in the Diesel plant is, perhaps an even more profitable service for De Laval Oil Purifiers. Installed for this purpose, they reduce carbon formation, lessen valve grinding, minimize ring, liner and fuel pump wear, and, in some cases, enable the burning of cheaper grades of fuel.

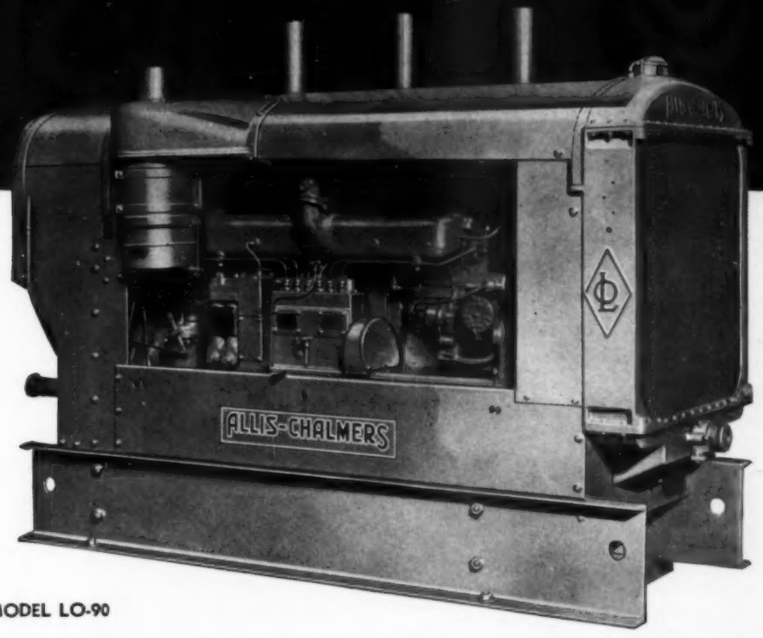
De Laval Oil Purifiers are available as individual purification units, or as complete, compact plants such as the De Laval "Uni-Matic" which includes pumps, gauges, heaters, etc. Units are direct motor driven, self-lubricated and ball bearing equipped. Bowls, or purifying members, may be of self-draining type for easy cleaning and are scientifically rated as to efficiency to give *Guaranteed Performance*.

Why not ask for further details in Bulletin No. 112?

**THE DE LAVAL SEPARATOR COMPANY**
165 Broadway, New York — 427 Randolph St., Chicago
DE LAVAL PACIFIC COMPANY, 61 Beale St., San Francisco
THE DE LAVAL COMPANY, LTD.
Montreal — Peterboro — Winnipeg — Vancouver

# DE LAVAL OIL PURIFIERS

# DEPENDABILITY
## COMBINED WITH LOW FUEL COST




MODEL LO-90

## *Controlled Ignition* IS THE ANSWER

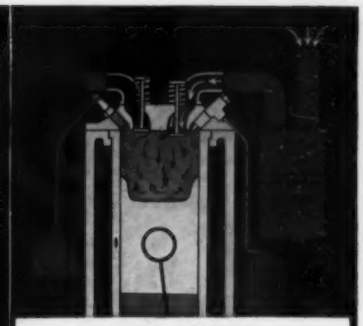
DEPENDABILITY is another big advantage of the Controlled Ignition Oil Engine. Controlled Ignition means low compression, smooth operation, minimum upkeep, a wider choice of fuels and lubricants. Controlled Ignition means instant starting, regardless of weather — another time-saver. In addition, Allis-Chalmers engines are built throughout for heavy-duty service. All have alloy cylinder liners, alloy steel exhaust valve seats, heavy-duty oil wash type air cleaner, oil filter, heavy-duty clutch and power take-off shaft. In fact, these engines were designed for HEAVY-DUTY service in Allis-Chalmers tractors. Investigate before you buy.

### ● BELT H. P. RATINGS AT 1050 R. P. M.

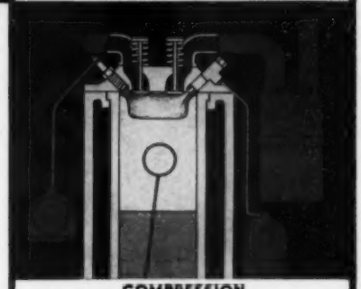
| | | | | |
|---|---|---|---|---|
| EO-60 | Diesel Fuel | 70 Max | | 56 Continuous |
| LO-90 | Diesel Fuel | 107 Max | | 85 Continuous |

# ALLIS-CHALMERS
**TRACTOR DIVISION—MILWAUKEE, U. S. A.**

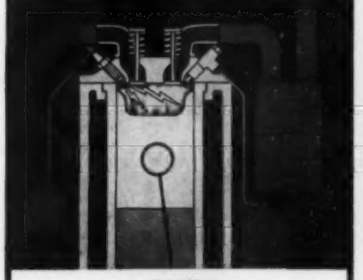
## CONTROLLED IGNITION OIL ENGINES



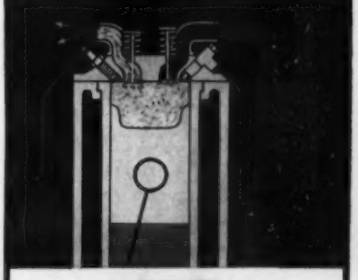
**INTAKE**
A measured quantity of cleaned air is drawn into the combustion chamber. The quantity is varied according to engine load by the governor.



**COMPRESSION**
The air is next compressed to approximately 160 pounds pressure. 60° before top dead center Diesel fuel is injected and thoroughly mixed with the air.



**POWER**
The mixture is next ignited by electrical injection of flame. Smooth, even power is delivered because of the gradual burning of the fuel charge.



**EXHAUST**
The exhaust valve opens and the burned gas is expelled from the cylinder in exactly the same manner as in a regular gasoline burning engine.

# AND NOW...

## The "Super Chief"

*Covering the 2227 miles between Chicago and Los Angeles in 39¾ hours, the "Super Chief" frequently exceeds 100 miles per hour. Since the route follows the old Santa Fe Trail, the tang of Indian country appropriately sets the theme for her comfortable appointments.*

OF INTEREST TO Diesel men everywhere, Santa Fe's last word in modern trains is lubricated with Texaco Products 100%. For example, the four 900 h.p. Diesels of the "Super Chief" use Texaco Ursa exclusively. Ursa withstands extreme temperatures and pressures . . . keeps engines clean . . . extends time between overhauls, thus assuring long, continuous service.

These are important reasons why more Diesel h.p. is lubricated with Texaco than with any other brand.

Trained lubrication engineers are available for consultation on the selection and application of Texaco Petroleum Products. Prompt deliveries assured through 2020 warehouse plants throughout the United States. The Texas Company, 135 East 42nd St., New York City.

*What, and Where, Texaco Products are used on the "Super Chief"*

| | |
|---|---|
| URSA OIL | Diesel Engines |
| CRATER | Motor Drive Gears |
| TEXAYCE OIL | Waste Packed Journal, Armature, Axle Cap Bearings |
| 632 OIL | Journal Roller Bearings |
| 860 DIESEL FUEL OIL | Diesel Engines |

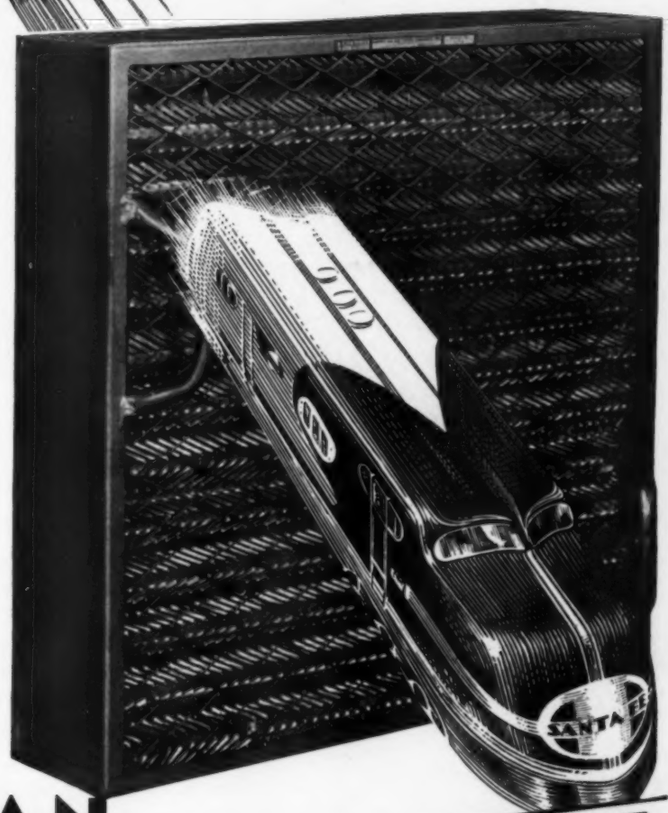
**TEXACO** LUBRICANTS FOR ALL TYPES OF DIESELS

# The Super Chief is AAF PROTECTED

THE new Santa Fe Super Chief will "come thru clean," because it is AAF protected! American Air Filters on the old Super Chief and hundreds of other coaches, diners, Pullmans and Diesel electric locomotives operated by the Santa Fe have demonstrated their ability to clean the air thoroughly, with a minimum of maintenance and expense.

We congratulate the Santa Fe, the Edward G. Budd Manufacturing Company, and the Electromotive Corporation upon the completion of this new train, which represents another step forward in "super" transportation.

Other streamliners and crack trains equipped with American Air Filters are operated by the following railroads: Canadian Pacific; Canadian National; Burlington; Rock Island; North Western; L. & N.; New York Central; Norfolk & Western; Southern Pacific; Southern; Texas & Pacific; Union Pacific; Texas & New Orleans; C. & O.; Boston & Albany; Boston & Maine; Great Northern; Lehigh Valley; C., St. P., M. & O; and the Gulf, Mobile & Northern.




## AMERICAN PERMANENT RAILROAD TYPE AIR FILTERS

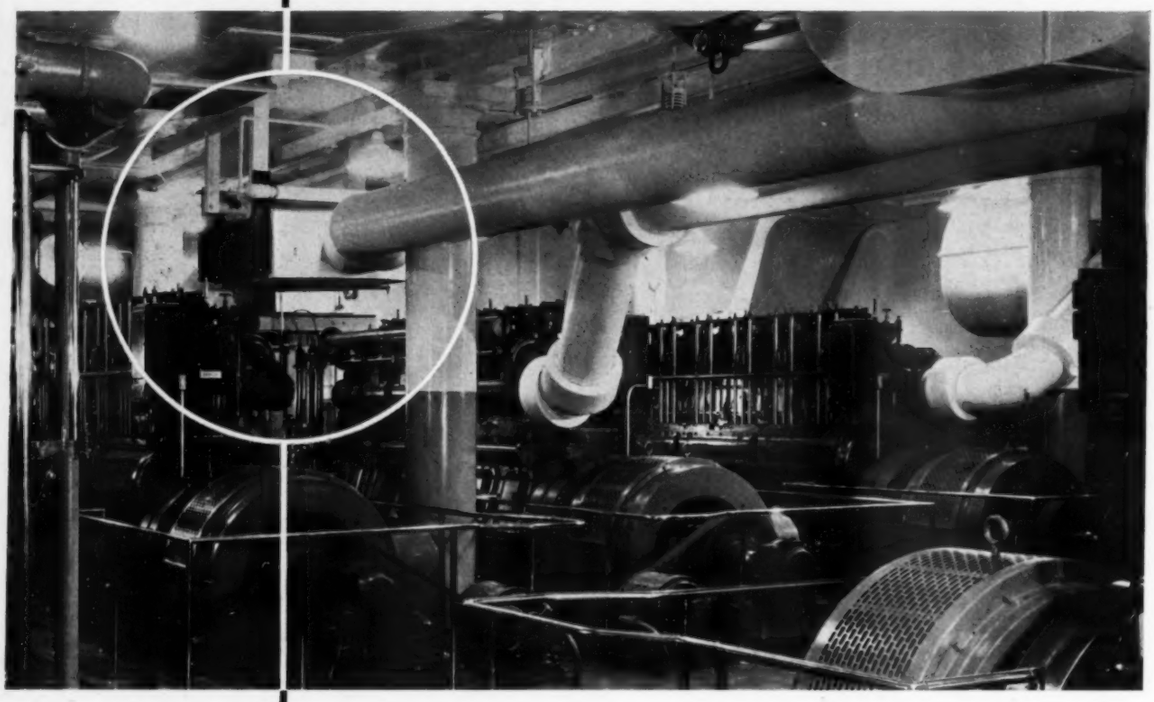
**AMERICAN AIR FILTER CO., Inc., 280 Central Avenue, Louisville, Ky.**

FOSTER WHEELER

# Steam and Hot Water

## at *no* fuel cost

Below: One of two waste heat water heaters in the engine room of Namm's Department Store, Brooklyn, N. Y. Capacity: 13.2 gals. per minute heated from 130° F. to 180° F.



## with Waste Heat Boilers

THE exhaust gases of a 200 h.p. 4-cycle Diesel engine furnish all the heat required to generate 154 lbs. of steam per hour at 5 pounds pressure in a Foster Wheeler waste heat boiler. One thousand horsepower Diesels will produce 640 lbs. of steam per hour. The recovery equipment occupies little space in the power plant, as the illustration indicates. The circle indicates the location of one of two waste heat water heaters in the Namm Department store.

Water heaters or boilers are supplied to suit plant requirements. The recovered heat may be used to:

*Operate steam-driven auxiliaries.*
*Provide building heat.*
*Preheat boiler feed water.*
*Reduce fuel requirements for process steam in industrial applications.*

*Write for bulletins WHE-36-1 and 2*

FOSTER WHEELER CORPORATION
165 BROADWAY NEW YORK, N. Y.

One of ten New Haven locomotives powered by Cooper Bessemer and Ingersoll Rand Diesels. Protected by Purolator.

The tug "Marvin" powered by a converted Caterpillar Diesel. Protected by Purolator.

# POWERED BY DIESEL

## PROTECTED BY PUROLATOR

**Diesel power marches on!**

**On land and sea... every month of the past year has witnessed new applications of the dependable and economical power afforded by Diesel engines.**

**Each new development in the Diesel field presents designing problems peculiarly its own... and PUROLATOR engineers have made it their problem to meet the manufacturers' requirements for perfect oil filtration on every type of Diesel engine.**

**The roster of Diesel engine manufacturers using PUROLATOR filters on the fuel and lubricating systems of their important new installations justifies our belief that we can be of service to you on either standard or special designs. We invite inquiries. Motor Improvements Inc., Newark, N. J. Makers of**

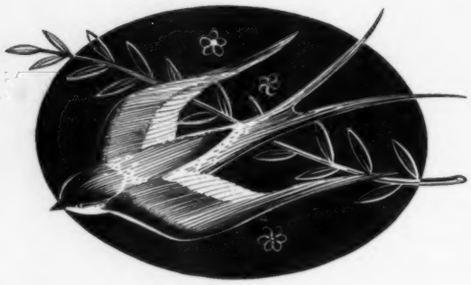
Municipal Light and Power plant at Tipton, Indiana. Generators driven by Winton Diesels. Protected by Purolator.

32-foot Baltzer cruiser. Powered by the new compact V-8 Kermath Diesel Engine. Protected by Purolator.

PUROLATOR

THE OIL FILTER

NO 5 OF A SERIES



# One Swallow Maketh Not Summer

*It takes more than an Adv. to make a Diesel Trade School*

**IT'S *easy* to go into the Trade School business. Anyone can do it "on a shoe-string" by writing an adv. and copying lessons out of a book. It's even profitable, for a while. That's why so many are at it. But it can't *last* on that basis.**

**Thirty-two years ago National Schools were founded. We had more than an adv. and a book. We have built a real school, a building with every facility, constantly investing in latest equipment—and most important, we have a Faculty of trained educators who KNOW Diesel training in all its ramifications.**

**Since 1905 the product of National Schools has been trained men—men who have learned the fundamentals of automotive engineering both theoretically and practically; men who have torn down and built up, repaired and operated Diesel Engines in National's Shops under actual working conditions, duplicating field routine.**

**Graduates of National Schools are thoroughly prepared to accept and hold responsible positions. They have received a course of training that they could not obtain in public schools, or in colleges or universities. They are furnishing the man-power seriously needed by the fast strides of the Diesel industry.**

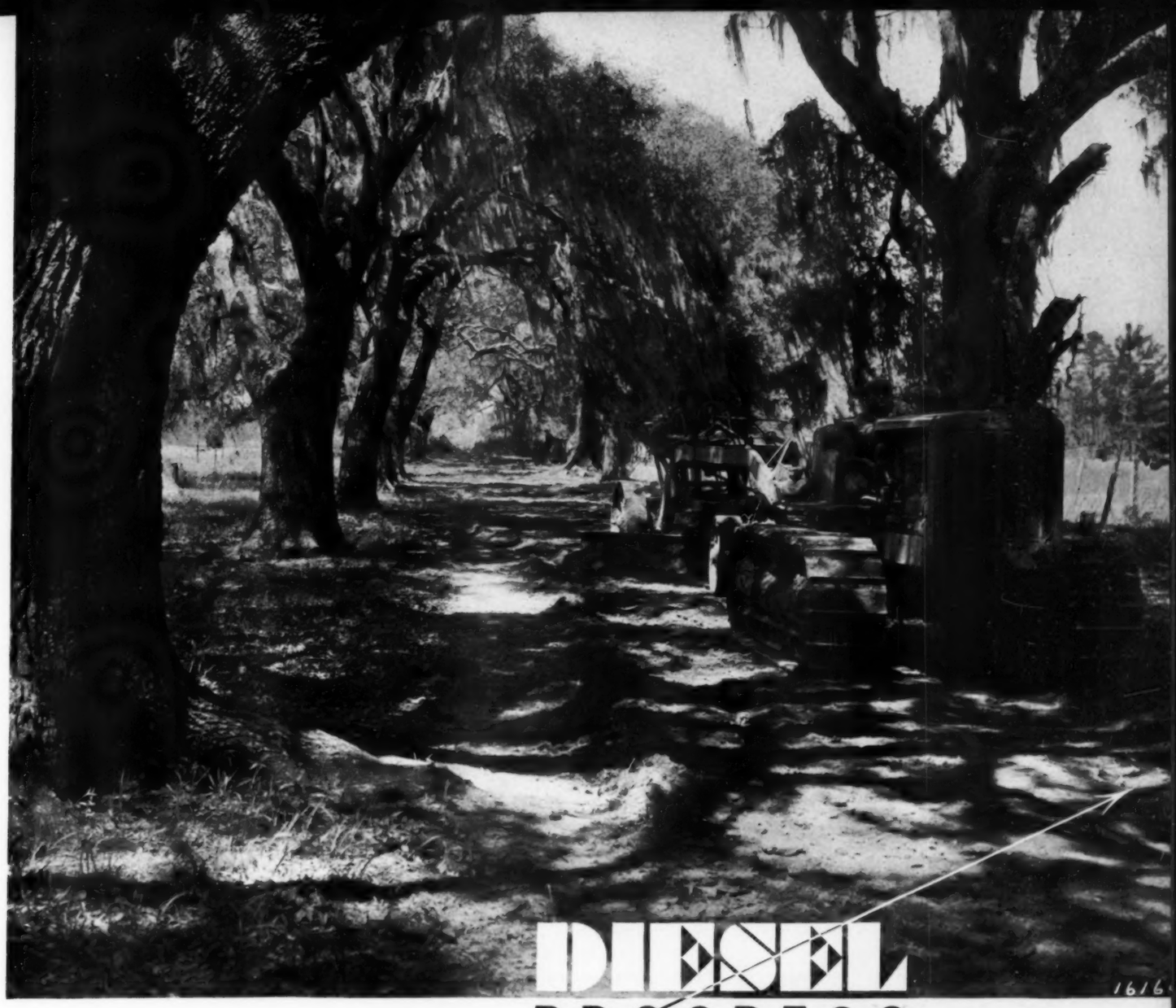
**The fact that National Schools have grown steadily from year to year to the position of a million dollar Organization is proof of the real utility of National's services and the honesty of purpose to fill an important place in industrial education.**

**Graduation from National Schools is evidence of thorough and comprehensive Diesel Training on the part of the graduate. Our service to Employers includes the recommendation of capable men after long personal observation of their particular abilities while they were attending National Schools. If you have need for *Trained Men* we can certainly assist you. Detailed information involves no obligation. May we receive your inquiry?**

## NATIONAL SCHOOLS

*4000 South Figueroa Street • Los Angeles, California*

[PIONEERS OF PRACTICAL TRAINING FOR 32 YEARS]



# DIESEL PROGRESS

## CONTENTS • JULY

FRONT COVER ILLUSTRATION — This striking artist's conception of the new *Super Chief*, latest symbol of modern Diesel progress, is used through the courtesy of the Edward G. Budd Manufacturing Company, who built the train. The two power units carry four Winton Diesels rated at 900 hp. each.

TABLE OF CONTENTS ILLUSTRATION — Roads near Cypress Gardens out of Charleston, South Carolina, are worked by a Caterpillar Diesel tractor and scraper at a cost of 27 cents an hour for fuel.

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# NEW SANTA FE "SUPER C

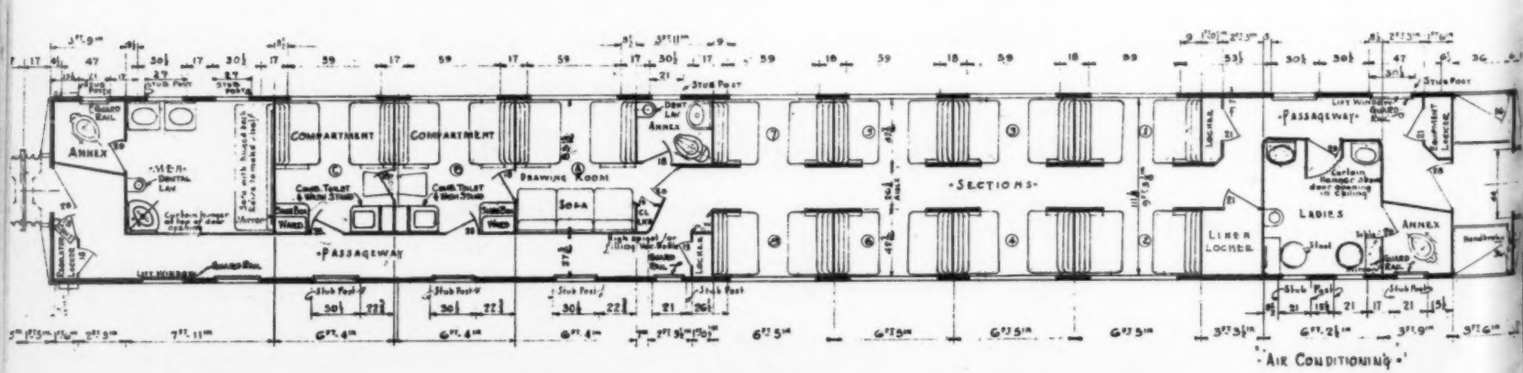
*By* CHARLES F. A. MANN

HERALDED as the "World's Most Beautiful Train," the new stainless steel, Budd-built streamlined train, the *Super Chief*, left Chicago May 3 on the first of several trial runs – just like the trial runs of an ocean liner – and launched a new era in the development of high speed passenger train service.

With every car completely detachable, as well as the two sections of its 3,600 hp. Diesel locomotive, and many of the experimental gimcracks left out completely, that were considered absolutely necessary two years ago, when Diesel locomotives and the magic word "Streamlining" were sweeping conversational and industrial America like wildfire – the new Santa Fe *Super Chief* may be considered as a model for the entire rail equipment rebuilding program of this date onward.

Point by point, from arrangement of the baggage car interior, construction of the dual-bearing wheel assemblies on each truck, the coupling system and even to the rear-buffer system, the *Super Chief* represents the last word in careful planning and, with a corps of artists and designers turned loose on the inside, with no limits set on their creative ability, its decorative scheme may be likewise labelled as near to perfection as possible.

The train consists of 8 stainless steel cars, with a total length of 642 ft. 1 inch and a total weight, including the locomotive, of approximately 1,370,000 pounds, which, compared with a standard train of identical capacity with a weight of over 2,000,000 pounds, is a remarkable achievement. This is particularly true in view of the fact that there was no special effort made to reach into the ultra flyweight brackets of some trains, but to scientifically reduce weight yet give its passengers the most comfortable ride possible to achieve on rails. It must be borne in mind that this train carries nothing but first class, extra fare sleeping car passengers, 70 per cent of them in private rooms, and on a 2,228-mile almost continuous run at sustained high speed. People who will ride it have a right to expect a train that will sleep all its passengers in a virtually soundproof car, and with no vibration.



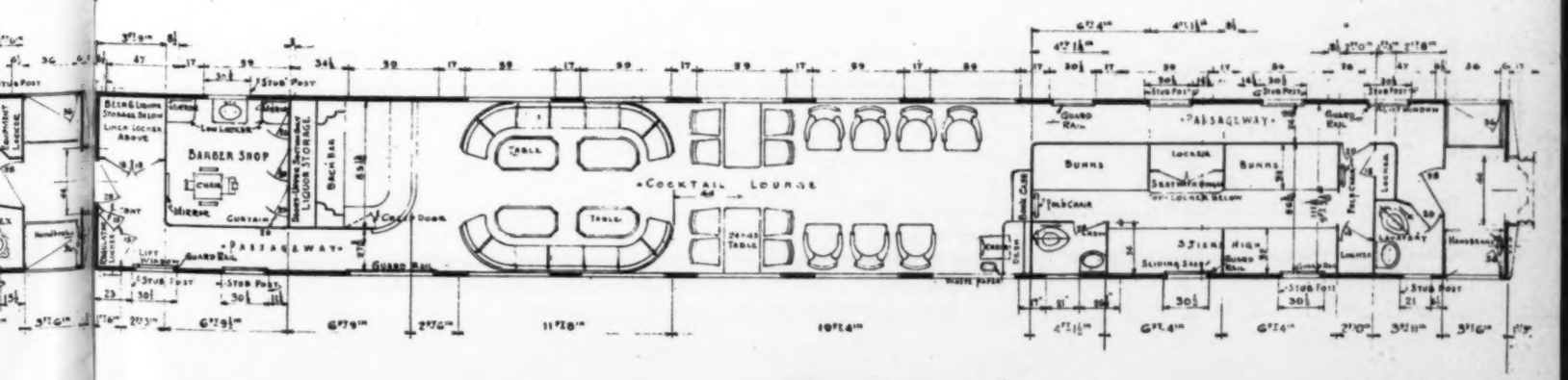
*3,600 more new Winton Diesel horsepower enter railway service for the Santa Fe.*

# R CHIEF"

The cars have an overall inside width of 9 ft. 3¼ inches and a floor height of 4 ft. 3 inches above the rails. Each car is equipped with two 4-wheel trucks, with an ingenious bearing system, providing an SKF rollerbearing set on each wheel, and, in case these bearings stick, the axle automatically starts revolving in a plain bearing, outside mounted in standard shells, just like an ordinary passenger car. There will be no road delays for wheel-bearing trouble. All wheels are 35 inches in diameter and of special steel. The Budd "Shotweld" system of construction and fabricating members and sheets has been used throughout the train, and the glistening silvery exterior of reverse fluted stainless sheets, characteristic of all Budd trains, has been adhered to. Windows extraordinarily wide, being 3½, 4 and 5 feet wide, double shatterproof glass, mounted in gum rubber, are used throughout the train, with no centerposts in any window set. Synthetic compounds and rubber compounds are used extensively for finish, fittings and trim throughout the train, while most of the movable furniture is of tubular aluminum and steel alloy, and all but one set of cushions are of the sponge rubber variety. Couplers between cars are a new design of the old type, having a spring buffer inserted in each knuckle, which gives an almost Tight Lock characteristic at no increase in weight. The train is not articulated. The high horsepower-weight ratio with the Diesel makes for absolutely silent starts, with no slack taken. Piping throughout the train is of seamless tubing. The retardation-control that was thought essential to high speed operation has been junked as an expensive non-essential. The air conditioning system is of the Carrier steam-jet system, using the heating boilers for cooling in summer and heating in winter, with no load off the axles other than power to run the fans. No auxiliary power plant is provided for air conditioning the train, thus eliminating space in the train for a separate power system. Each of the 32 bedrooms and 16 sections has individual lighting control and automatic thermostatic heat control.

The plan of having the dining car and lounge-barbershop-dormitory car placed together in the middle of the train, with a roomy observation lounge at the rear end gives the limited passenger list a wide variety of "loafing space." There are 16 section sleepers in the two forward cars, with a capacity of 32; bedrooms have a capacity of 26; compartments, a capacity of 22 and drawing rooms, a capacity of 24, or a total of 104 beds on the train, the rest of the 182 seats being for lounging purposes. Use of cork, linoleum, rubber tile, hair insulation and thick carpets generously throughout the train makes it almost soundproof.

Double cylinder air brakes, truck mounted and connected to the car bodies by heavy rubber tubing, make the train noiseless when braking heavily or stopping.



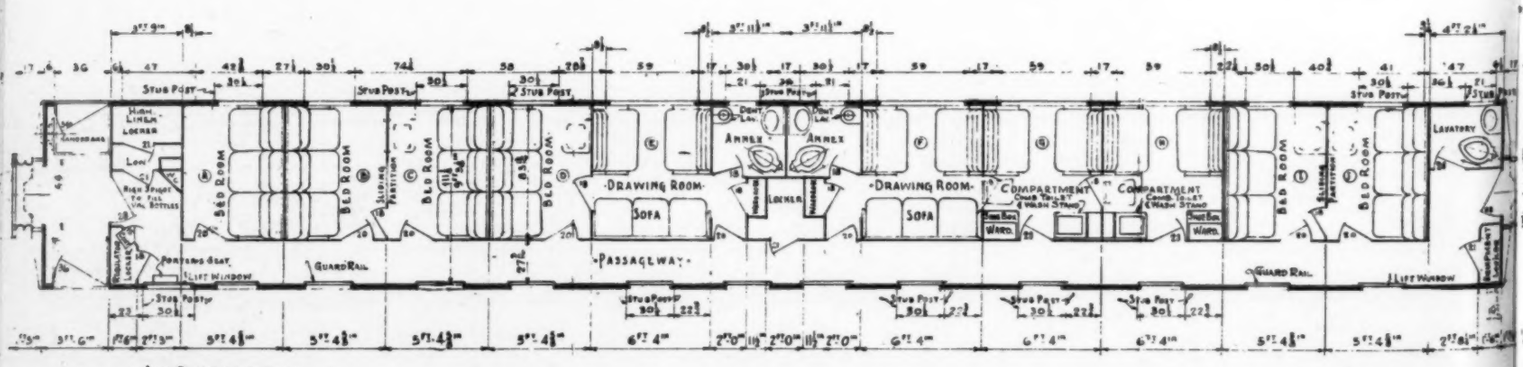
Unlike any previous American train, the entire interior is done in a series of rare wood veneer finishes, with over 30 kinds of rare American and tropical veneers used to panel the different rooms. Only the rear-end observation lounge has a sprayed lacquer finish, this to balance the Indian motif of this room and its furnishings. Silverware and dishes and even linens were all created especially for this train and the kitchen is a model of stainless steel trim, good ventilation and roominess, with every electrical appliance that can be found.

The striking effects obtained by the use of wood veneers instead of ordinary painted surfaces, together with bright metallic trim and a varied upholstery scheme in almost every room, gives the train a unique atmosphere not found on any other streamliner ever built.

The first car is a 79-ft. baggage car while the next two cars are identical sleeping cars containing 8 open sections, two compartments and a drawing room, and are each 79 feet long. A feature of these cars is the novel system used to handle the upper berths. Instead of folding upwards, a track system permits their being vertically raised about two feet in daytime, leaving about 7 feet of clear headroom. Panels extend around the ends giving almost stateroom privacy at all times. Double windows, special lights and air conditioning make the upper berths really inviting.

The bar-lounge car, seating 29 is equipped with a modern barber shop and a bunk room for 12 of the train crew, thus permitting the cooks and dining car crew handy access to their living quarters without going clear through the train to reach them. This car is 79 ft. 10 inches long and adjoins the 83-ft. dining car, seating 36.

The next two cars are 79 feet long and each contain 6 bedrooms, 2 compartments and 2 drawing rooms. The last car is 79 feet long



and contains 1 bedroom, 2 drawing rooms and 3 compartments and a 24-ft. observation lounge section. The rear buffer system permits extraordinary width and permits unusual strength of members, by having only two thin side piers and two end piers exposed in the room.

Though built at the shops of the Electro-Motive Corp. in Chicago, some miles away from the Budd plant at Philadelphia where the cars were turned out, the two-unit Diesel locomotive blends perfectly with the exterior of the train. Each unit consists of a 74-ft. long cab, containing two 900-hp. 12-cylinder V type Winton 2 cycle Diesels of exactly the same type as used in all other major streamlined trains in the U. S. A.

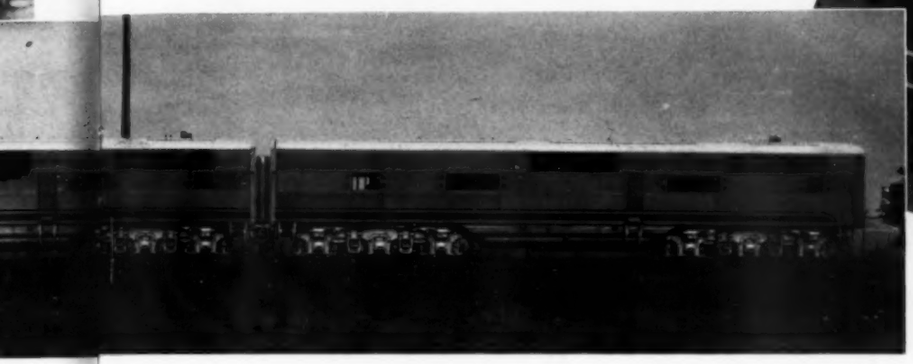
A departure in running gear is noted in this model, being the first of its type turned out by Electro-Motive, in that it has 6 wheel trucks, each wheel being 36 inches in diameter. The outer pairs of wheels on each truck each have a 450-hp. traction motor geared to the axle, while the center wheel pair runs as an idler shaft to carry part of the load.

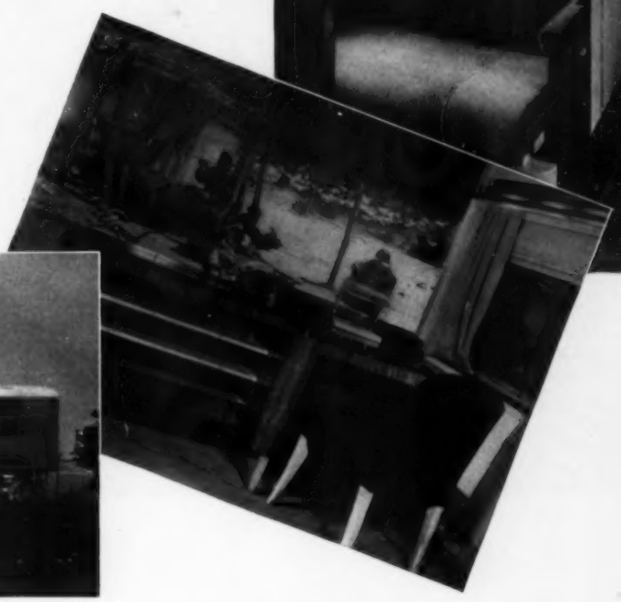
The forward unit has a new type front end extending 13 feet forward of the pilot house door. Water and air tanks are stored beneath the hood, while the engineers cab is roomy enough to seat 8 people, and extra visibility from all sides is provided by 8 safety glass windows.

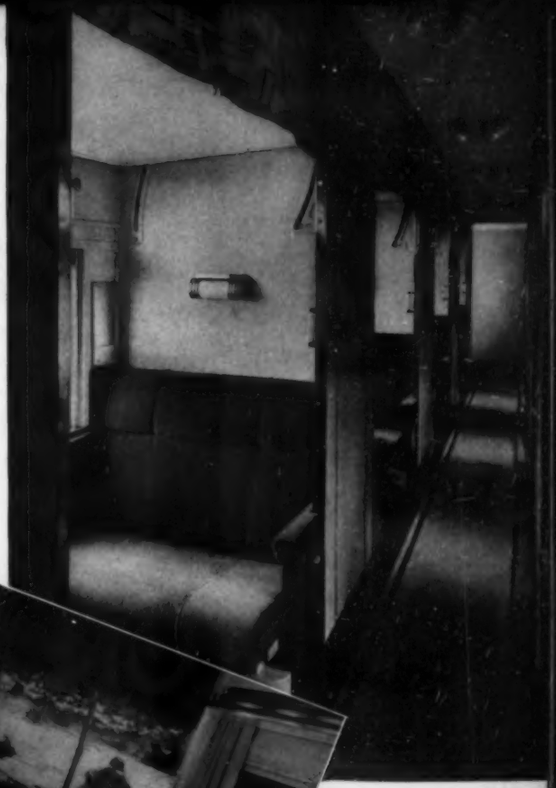
The four 900 hp. Diesel units are essentially the same as in earlier designs, except for greater roominess in the engine rooms and the admittance of cooling air through side grilles mounted on the upper sidewalls of each unit. The twin radiators are set vertically along each bank of exhaust pipes to permit rapid draining when the engines are shut down. The control system is the unified type, eliminating the changeover from series-parallel-shunt and the separate engine throttle, with but 8 positions between stop and full speed.

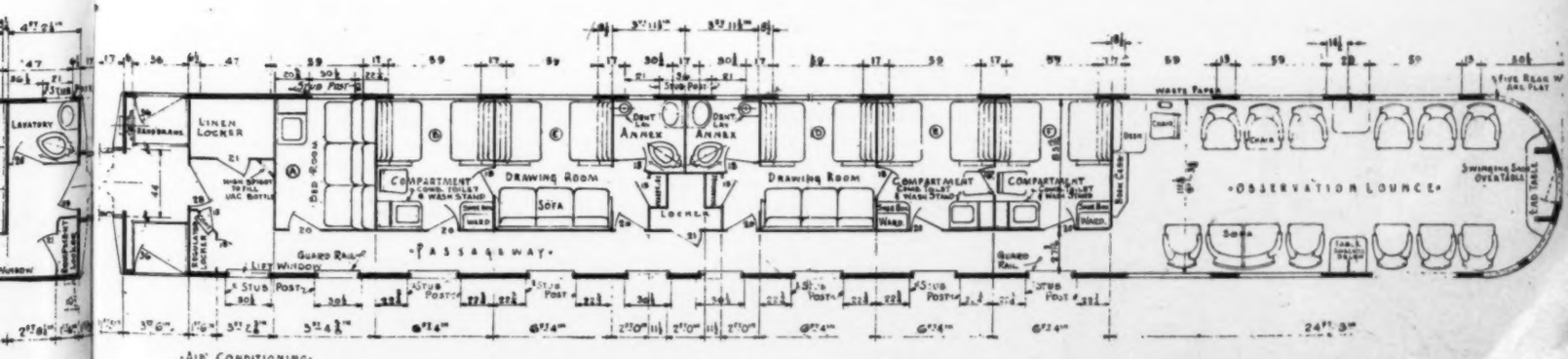
The second 1,800 hp. unit is identical with the first, except that the space used by the pilot house and hood on the first cab is occupied by two 2,200 lb. Vapor Car Heating Co. boilers. Fuel for a continuous run of 1,200 miles is carried on each unit, and an extra supply of fuel and water for the heating boilers is also carried. Fuel oil pumps, filters, measuring tanks, etc., are carried in duplicate on each unit, and each of the 4 main engines drives the pair of traction motors underneath it, only.

Remarkable simplicity and refinement characterize this first of the new series of EMC Diesel passenger locomotives and speeds are possible up to 130 miles per hour. All generators and motors are made by General Electric. A 2-cylinder, Gardner Denver air compressor is belt driven off the end of each main Diesel and a 32-cell Exide battery set is provided in each cab. SKF journals are used on each of the six wheels on each truck.









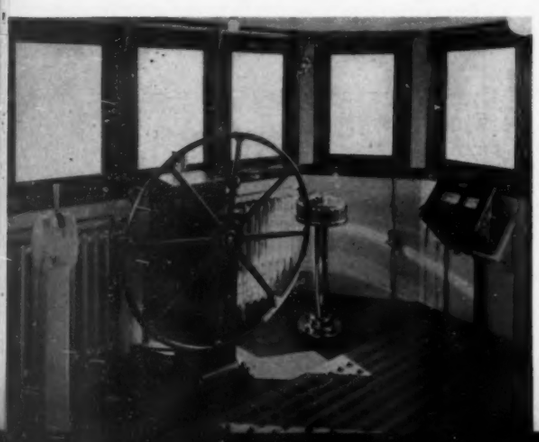
# DIESEL FERRY "NORFOLK COUNTY"

*By* J. S. MERTENS, N.A.

NOW in operation for the last four months on the Elizabeth River, between the cities of Portsmouth and Norfolk, Va., the Diesel-electric ferry *Norfolk County* has earned a great public popularity for comfortable service, as well as a high esteem from the management of the Norfolk County Ferries for dependable and highly economical operation.

Designed and built under the supervision of J. S. Mertens, Consulting Naval Architect of Newport News, Va., the main particulars of this vessel are as follows:

| | |
|---|---|
| Length over all | 175′ 3″ |
| Beam moulded on deck | 42′ 0″ |
| Draft | 8′ 6″ |



Being of the conventional ferry boat type, she is double ended, having four lanes on her main deck, accommodating about 45 automobiles of average size, with passenger cabins on the side of the overhanging main deck, and while not radically different in appearance to many of her sister vessels in existence, this vessel is probably the most modern, safest, fastest and certainly the most advanced ferry vessel of her type and size in the United States.

Built at a cost of just a little over a quarter of a million dollars, the vessel embodies the latest designs known in the science of shipbuilding and marine engineering, and has many interesting features.

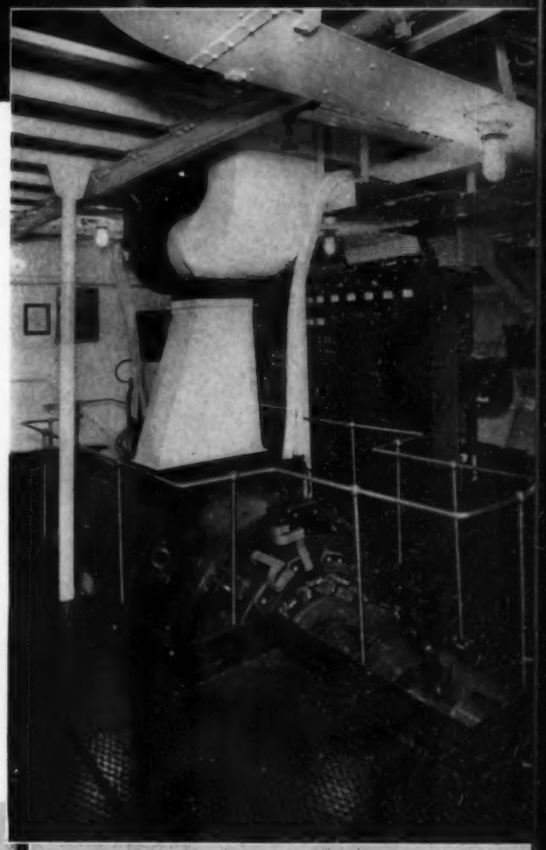
Subdivided into seven watertight compartments by six steel bulkheads, the vessel is not only unsinkable, but will remain affoat with a large margin of safety and without discomfort to those aboard, if, when fully loaded, any of these compartments becomes flooded, as in the case of a collision or other accident that may cause puncturing of the shell. Also, should any two compartments become flooded, the vessel will not be in danger of sinking, although in that case the remaining freeboard will, of necessity, be small. Built entirely of steel and other fireproof materials, even the paneling in the passenger cabins is made up of specially prepared rust proof steel. Danger from fire is entirely

eliminated. The automobile deck is wide and spacious for accommodation of 45 automobiles, and is designed to withstand great loads for transportation of extra heavy loaded motor trucks and trailers. A special feature of the vehicle deck is that it is paved with fireproof and non-skid tiles, of a mineral and crushed rock composition, cemented on the steel deck plating.

In regards to the propulsion machinery, it may be said that while the power plant is small in comparison to large ocean liners, in scientific application and engineering principles the vessel is not outrivalled by anything afloat. Power is furnished by two Fairbanks-Morse 8 cylinder, 5" bore by 8" stroke opposed piston type Diesel engines of the 2-cycle, solid injection type, developing continuously 400 hp. at 1,200 rpm., and being capable of 25 per cent overloads for periods not exceeding one hour. While slow speed, heavy types of opposed piston Diesel engines have been previously installed in large ships with extremely satisfactory results, it may be noted that to this ferry, as far as is known, falls the distinction of being the first commercial vessel equipped with this new type of high speed, opposed piston Diesel engines, which, in the writer's opinon, will be the forerunners of many similar installations in the near future. on the strength of their performance, coupled with the great stamina displayed in consideration of their weight and size.

Each Diesel engine directly drives one 245 kw., 250 volt Elliott main generator and one 15/30 kw., 125 volt exciter. The propulsion motor is a double armature, variable speed motor of 600 hp. at 180 rpm., capable of 25 per cent overload for a period of one hour.

The auxiliary machinery consists of two Sperry hand-electric steering gears of the following-up type; one Fairbanks-Morse piston type electric and gear driven bilge pump; one F-M electric driven air compressor; one F-M electric driven rotary pre-circulation and after-cooling pump, of which more later; one Sharples enbloc type lubricating oil centrifuge. Several smaller electrically driven lubricating and fuel oil transfer pumps and one rotary electric converter, converting 220 volt AC shore current into 120 volt DC.



Maxim intake and exhaust silencers are fitted on the main Diesels, and in addition to the previously mentioned auxiliaries should be mentioned two electrically driven rotary fire pumps capable of delivering 250 gallons of water per minute each against a head pressure of 100 lbs. These are installed in conformity with the latest rules of the U. S. Bureau of Navigation and Marine Inspection.

On its trial trip over a measured mile course, the vessel attained a maximum speed of 12.4 knots per hour with the propulsion motor running at 180 rpm., and a total input of 1,050 amps. at 495 volts, or in simple figures, 697 hp., counting all losses. It is the desire of the management, however, to operate the vessel ordinarily at approximately 12 statute miles per hour or approximately 10.5 knots.

*Engine room views of the "Norfolk County," showing the port and starboard Fairbanks-Morse Diesels, Elliott generators and the starboard propulsion motor.*

# W. T. BURTON—Succ
# Uses Atla

*This is the dynamic Wm. T. Burton, actually so busy with his towing business that he wouldn't take off his hat to have his picture taken. His office opens at 6:30 a.m. and closes at 9:30 p.m. and during those hours, he has his fingers on every detail of his vast business.*

*The city home of W. T. Burton is one of the show places of Lake Charles. It was furnished by Marshall Field & Co. of Chicago, is air conditioned, and just the kind of place any successful business man would be proud to call his home.*

KEITH McKERROW,
*powered by a 6 cylinder, 10" x 13", 200 hp. Atlas Marine Diesel.*

ROY L.,
*powered by a 6 cylinder, 7½" x 10½", 120 hp. Atlas Marine Diesel.*

LEADER,
*powered by a 6 cylinder, 7½" x 10½", 120 hp. Atlas Marine Diesel.*

ETHEL BURTON,
*powered by a 6 cylinder, 11½" x 15", 275 hp. Atlas Marine Diesel.*

JACK LAWTON,
*powered by a 6 cylinder, 7½" x 10½", 120 hp. Atlas Marine Diesel.*

DOWN in Louisiana, where Diesel tug boats do the work that is done by railroads in other parts of the country, W. T. Burton of Sulphur, is regarded as one of the largest and most successful operators.

Those who know him best ascribe his phenomenal success to his astuteness in keeping his tow boats towing. A tow boat is profitable only when it's towing and W. T. Burton leaves no stone unturned to keep his boats moving.

The Burton activities are concentrated on the towing of oil and oyster shell, used in the surfacing of highways. Burton tows oil for anyone—but to make sure that there is always plenty of oil to be towed—regardless of competitive conditions, he develops his own oil fields—tows the oil in his 90 barges to his own tank farm, from which oil tankers take it into world commerce.

To make certain that there will be plenty

**ATLAS IMPERIAL DIE**
**OAKLAND, CALIFORNIA**

**ATLAS IM**

# ...ccessfull Tow Boat Operator, ...tlas Diesels

*Here is the loading dock and pump house from which Burton oil moves regularly to the refineries of Louisiana and Texas and occasionally to foreign ports.*

*This is a part of the tank farm of W. T. Burton, where he concentrates the crude oil towed in by his own tug boats from his own oil fields.*

*Here is the genial Keith McKerrow, marine superintendent for W. T. Burton. He is in charge of the dispatch of all tugs, the tank farm and loading docks.*

of work towing oyster shell, Burton contracts the building of highways—dredges the oyster shell from beds he has leased—tows the oyster shell over a radius of sixty miles. Burton owns his own shipyard, builds and repairs his own boats and supplies them with every necessity from his own commissary at Sulphur.

After careful analysis, Burton decided in 1929 that he could make the towing business more profitable by reducing his operating costs with Diesel power. He wanted an engine that was thoroughly dependable and that would stand the gaff under continuous operation. He bought an Atlas Diesel for the *Powhatan* in 1929 and since, he has powered 11 tug boats with Atlas Diesels, ranging from 80 to 300 hp. In seven years he has bought Atlas Diesels exclusively for his new boats, and when old boats need repowering, they get Atlas Diesels, too.

EVELYN SHADDOCK,
*powered by a 6 cylinder, 9" x 12", 160 hp. Atlas Marine Diesel.*

POWHATAN,
*powered by a 6 cylinder, 10" x 13", 200 hp. Atlas Marine Diesel.*

W. T. BURTON,
*powered by a 6 cylinder, 11½" x 15", 275 hp. Atlas Marine Diesel.*

BILLY B. LAWTON,
*powered by a 6 cylinder, 11½" x 15", 275 hp. Atlas Marine Diesel.*

LEONORA,
*powered by a 6 cylinder, 9" x 12", 160 hp. Atlas Marine Diesel.*

AL DIESEL ENGINE CO.
IA • MATTOON, ILLINOIS

MPERIAL

# DIAMOND T HERCULES DIESEL TRUCKS

A RECENT and most important step in the application of Diesel engines to motor truck service is the announcement of a standardized line of Diamond T Diesel units, with capacities of from 2 to 4½ tons. Spectacular records of performance have been established during past years by large Diesel trucks, some ranging as heavy as twenty tons, but in order that Diesel operating benefits may be available to the average user, capacities of one-fifth to one-tenth of that maximum were required. Diamond T have successfully met those limitations with the co-operation of the Hercules Motors Corporation who supply the Diesel engines.

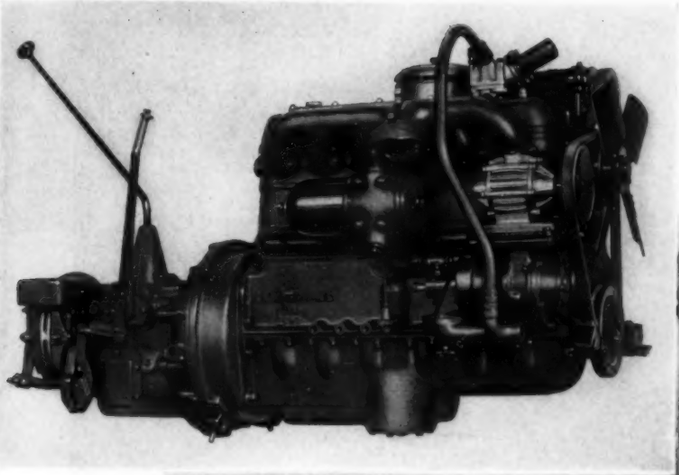
In addition to meeting the demand for a medium sized, standardized Diesel truck, the Diamond T organization have prepared a most instructive booklet dealing specifically with the application of Diesel engines to trucks. Every new development during its early years suffers from word of mouth misstatements and half-truths among its potential users and the Diesel truck is no exception. Because gasoline and Diesel trucks are almost identical in many respects and diametrically opposed in others, the operator considering Diesels (and who is not?) should base his decision on correct and reliable information from a reliable source.

The above mentioned booklet, entitled "A Brief Discussion of High Speed Diesel Trucks," presents its subject intelligently, accurately and without bias in non-technical language. After a short general introduction, such points as compression, efficiency, mileage, cold weather starting, and general performance are discussed individually and, in conclusion, the honest and proper limitations are set down so that operators and owners can decide whether or not their own particular business justifies a Diesel truck. As has been the policy of DIESEL PROGRESS since its inception, this booklet does not state that the Diesel should be the universal prime mover to the exclusion of all other types of engine, but it does show that very impressive savings could be effected by many truckmen now using gasoline power. Every one interested in trucks and commercial trucking should read this bulletin. Copies are available upon request to the Editor.

As the illustrations show, there is practically no limit to the variety of service now handled by a Diamond T-Hercules Diesel chassis. The Bos unit above carries perishables between Omaha and Chicago and maintains a fast refrigerator service for from 8 to 10 tons on regular schedules. On the next page, at the top, is the leader of the Consolidated Rock Products fleet in Los Angeles. Rated at 2½ tons nominal capacity, this truck carries a five yard body and its owners report its fuel consumption at 11 miles per gallon which is probably an all-time record for this size and service. For general transfer work and intercity hauling, the Monroe trailer and tractor at the right are being operated for one-fourth the fuel cost of a similar gasoline powered unit.

In general, Diesel truck owners report an average saving of about 75 per cent on fuel and this has been confirmed by experimental tests throughout various sections of the country.

*The booklet, "A Brief Discussion of Diesel Trucks," described on this page, is of important interest to every truck owner and will be sent free upon request to the Editor of* DIESEL PROGRESS.



*All three trucks are powered by Hercules Diesels of the type shown. This well known Diesel unit has been selected by Diamond T as standard equipment for their new line of high-speed Diesel trucks.*

# LONDON LETTER NO. 20

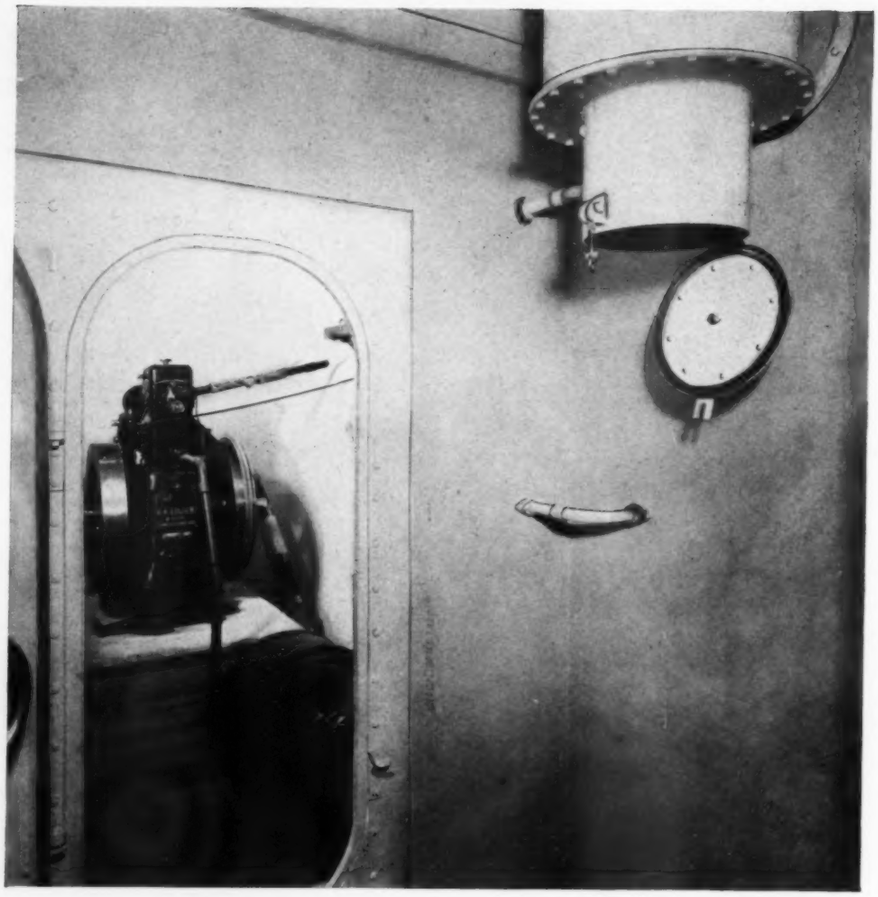
*By* G. R. HUTCHINSON*

ONE of the most interesting uses to which the modern oil engine has been put was recently brought to our notice in the heart of residential London. In a large block of luxury flats which has just been erected in the Regents Park area of North West London provision has been made for an air-raid shelter. To American minds this precaution may seem extraordinary, but on this side of the Atlantic there has been a great deal of alarmist talk regarding possible aerial attack in the future and the precautions which should be taken against such forms of warfare. Apparently with a view to making this particular block of flats more "attractive" to prospective tenants, this bomb-proof shelter has been put up in the basement and a particularly strong and well-thought-out job it is. It is so designed that if the entire flat building were demolished the "funk hole," as the shelter has been unkindly called, would remain intact and accessible. In it there is provision for sleeping all the tenants of the flats on the bunk bed shelves which are seen in the accompanying illustration around the walls of the shelter. Very thorough ventilating arrangements, air-conditioning and gas filtering are provided; the shelter has a separate system of lighting, with an additional emergency lighting system, and 2,000 gallons of drinking and washing water can be stored for use in the event of war emergency.

Power for driving the fans for the ventilating system and for supplying current for the emergency lighting arrangements is ensured by means of a small Lister Diesel-generator set which is shown in its "strong room." This is a single-cylinder engine of 5 bhp. at 600 rpm. and it drives a 3.5 kva., 230-volt generator. The engine is mounted on a large block of concrete with a compressed cork mat interposed to ensure that no vibration is transmitted to the building, and the Diesel draws its air supply from the ventilating ducts of the shelter.

Should the Lister engine fail or the fuel supply become exhausted (the fuel tanks allow of

*Editor of "Gas and Oil Power" and Managing Director of the Whitehall Technical Press, Ltd.*



*A Lister Diesel operating in a bomb-proof cellar of a London apartment house. Below: The new Diesel standby unit at the Earl's Court Exhibition buildings. The dials are Rototherm thermometers, one for each cylinder.*

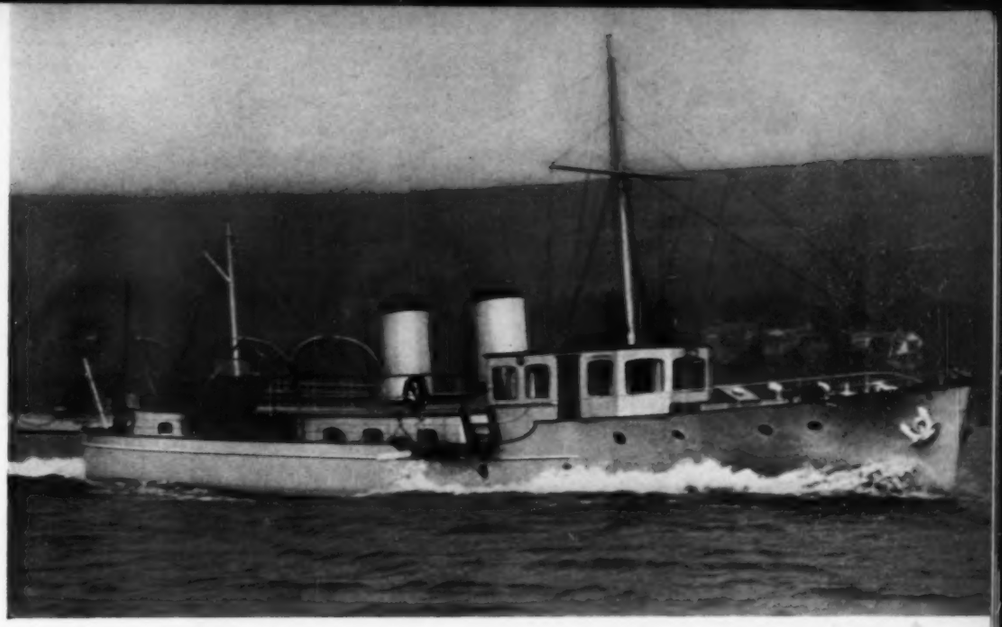
the engine running continuously for a long period) the fans can be operated through a special arrangement of chain gearing driven from a battery of cycle frames located in the shelter! The idea is that in such an emergency volunteers will be called from the occupants of the shelter to man the cycle frames and so drive the fans, which are normally electric motor-driven. The whole arrangement sounds a very remarkable undertaking and is, perhaps, an illuminating reflex on the stirring times in which we live!

Within a few miles of the above-mentioned unique Diesel installation we also had the opportunity last month of visiting a most interesting Diesel plant of a standby nature. We refer to the Blackstone-engined generator which has been installed in connection with the immense Earl's Court Exhibition buildings now approaching completion in the Kensington neighborhood. When finished, this will be the largest covered building in Europe and will be used for athletic meetings, exhibitions, etc.

The electricity Grid arrangements in this country have been the subject of a certain amount of well-merited criticism and doubtless for this reason the Earl's Court authorities deemed it desirable to provide their own standby plant. Wisely, they have chosen Diesel generated electricity, the engine being the very neat seven-cylinder Blackstone unit illustrated, which is rated at 280 bhp. at 600 rpm. This is a four-stroke engine with an open combustion chamber and has injection equipment of Blackstone design. Each cylinder is equipped with a Rototherm dial thermometer. The unit is directly coupled to a compound-wound Crompton Parkinson generator rated at 187 kw., this set supplying the current to a large Exide battery installation from which the emergency lighting current, etc., is taken. A motor-generator set is provided in connection with the Exide batteries so that these may also be charged from the mains. Normally, the Blackstone engine is started by compressed air, but should the air bottle be exhausted and the motor-driven compressor not be available, the engine can be started off the Exide battery by motoring it round, using its generator as a starting motor.

Since the last issue of DIESEL PROGRESS was published, an unusual yacht has been built for a Scottish enthusiast in which propulsion is by means of three A.E.C modified road vehicle engines.

The vessel, which is 95 ft. long, is noteworthy in having two funnels, and, as the illustration



*Diesel yacht 333, her yard number and retained as her name.*
*Below: The spacious forward lounge and navigating station.*

shows, has the appearance of a yacht of much larger size. Intended for cruising in the West Highland and French canals, draught limitations were important and for this reason triple screws were adopted with facilities for running on one, two or three propellers, according to the size of the waterways being navigated, the speed required, and so on.

Each propeller is driven by a six-cylinder A.E.C. oil engine, which employs the Ricardo air-cell combustion chamber and is very like the bus unit with the exception of the cooling arrangements, which are modified, and the provision of a cast-iron crankcase in place of the standard aluminum alloy one. Propulsion is through a reverse and 3 to 1 helical reduction gear. As each engine is rated at 100 bhp. at 1,650 rpm., it follows that the propeller speed is reasonably low and the efficiency correspondingly good. The oil fuel bunkers are of sufficient capacity to give the vessel a radius of 2,500 miles and in her accommodation and furnishings the *333* will bear comparison with any larger boat.

Before leaving the subject of A.E.C. Diesel engines, which have figured prominently in the Diesel news of this country in recent weeks, it is interesting to record that at the end of April Capt. G. E. T. Eyston, the famous British racing motorist, set up some very fine records with his A.E.C. engined Diesel car *Black Magic*. These were made in Paris, when he covered rather more than 105½ miles in the hour, thus breaking his own hour record for Diesel-engined cars; the previous figure was

103.01 mph. The engine, incidentally, is basically the same as the six-cylinder units used in buses, railcars, and small water craft.

Turning now to the "heavier metal" in the Diesel world we have to record the completion of the handsome refrigerated motor cargo liner *Rochester Castle* by Harland & Wolff, Ltd. This is the first of a pair of cargo liners which have been built at Belfast for the Union Castle Mail Steamship Co., and with her sister ship. *Roxburgh Castle*, now completing, they will help to operate the high-speed deciduous and citrus fruits service between the United Kingdom and South African ports, together with the rather smaller *Rosslyn Castle* and *Rothesay Castle* which were built in 1935. The *Rochester Castle* is 474 ft. long overall, and has a gross tonnage of 7,795 tons. Propulsion is by means of an eight-cylinder two-stroke cycle double-acting Harland-B. & W. engine rated at 7,000 bhp. at 93 rpm. The cylinders have a bore of 620 mm. and a stroke of no less than 1400 mm. The engine is of the uniflow scavenging type with exhaust valves in the cylinder covers. The service speed is about 16 knots and the dead-weight capacity about 8,500 tons.

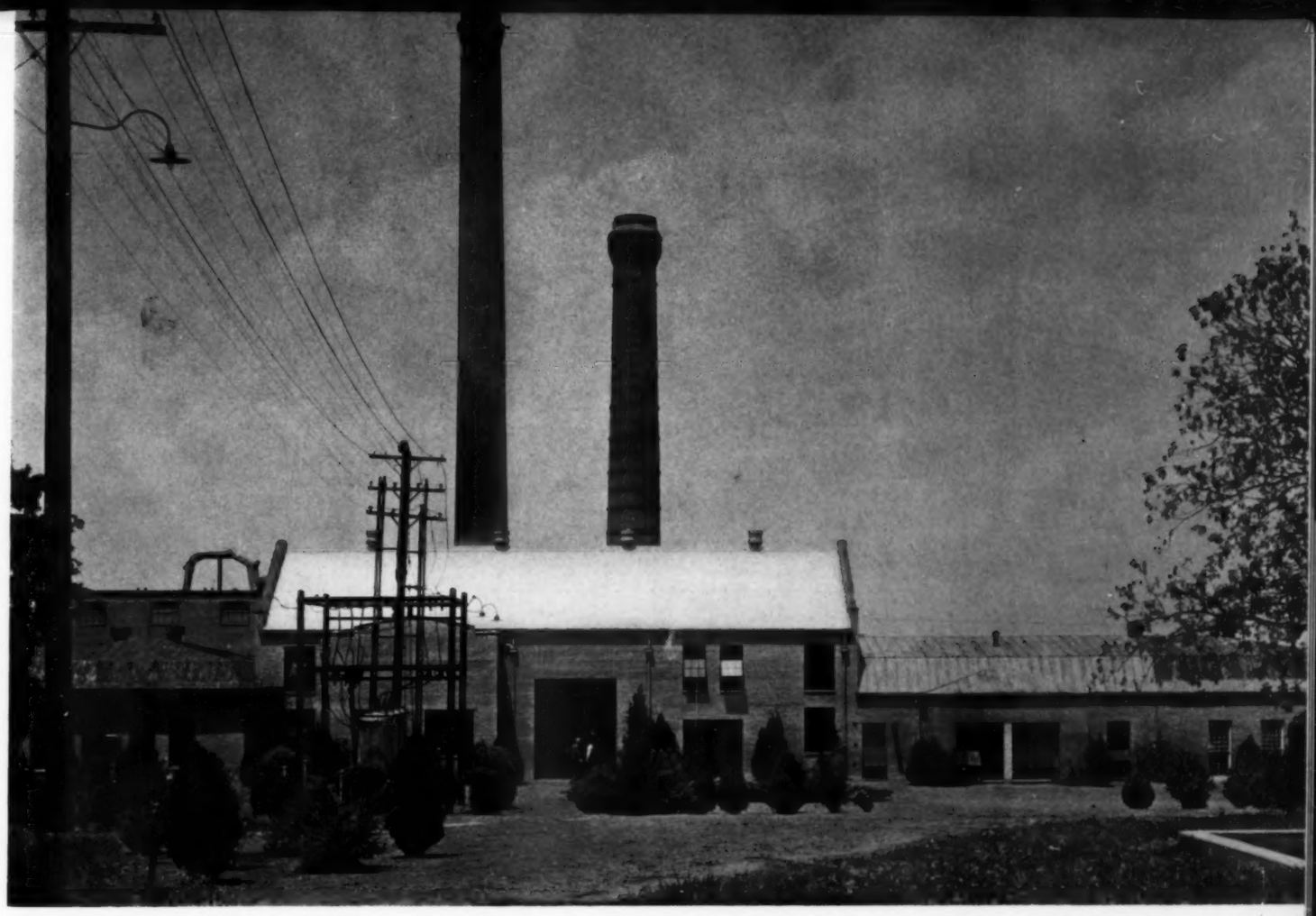
This engine, which is illustrated on the test-bed, is of particular interest in that the exhaust piston valves (the upper ones are clearly shown in the illustration, together with part of their driving gear) are driven from eccentrics on the crankshaft instead of through a chain-driven layshaft at the side of the main crankshaft as in previous engines. Cylinder covers and jackets are fresh-water-cooled, while lubricating oil is used for cooling the pistons. Diesel auxiliaries are provided in the engine room, there being three 300 kw. Diesel-generators.

*7,000 hp. Burmeister & Wain engine for the new M.S. "Rochester Castle." A similar unit drives the new sister ship, "Roxburgh Castle."*

*The London Passenger Transport Board are taking delivery of 100 such Diesel buses as shown below.*

As is now fairly generally appreciated in America, the Diesel bus and coach have become remarkably popular in this country. A recent statement issued by the makers of the well-known Leyland vehicle showed that for some time past of the total orders received for large passenger vehicles 97 per cent had been with Diesel drive. When it is remembered that Leyland and A.E.C. share the bulk of the commercial vehicle business in this country the significance of this figure cannot be overemphasized.

The accompanying illustration is of particular interest, apart from the foregoing facts, because it shows work in progress on a batch of no fewer than 100 oil-engined buses which Leyland are now completing for the London Passenger Transport Board; the Board, it may be recalled, standardize A.E.C vehicles (Diesel propulsion is now used exclusively by London Transport, incidentally) and only for special reasons are orders for vehicles placed elsewhere than in the large A.E.C. works at Southall, near London. This order for Leyland vehicles, all of which will have Leyland direct-injection engines, is the largest which I can recall the L.P.T.B. placing with an "outside" firm for some considerable time.



# GREENVILLE, TEXAS

*By* ORVILLE ADAMS

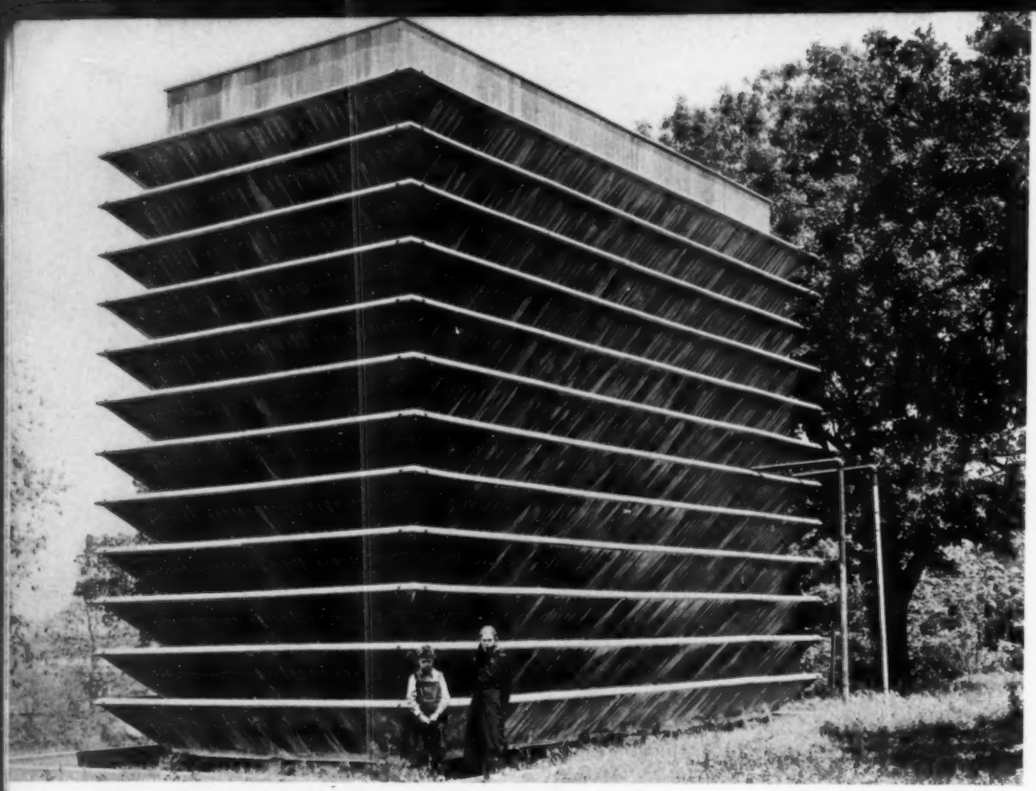
THE city of Greenville, Texas, capital of the famous black land belt of the state, has owned and operated its own utilities for almost half a century and has never granted an outside franchise for any purpose. Starting in the early days with an old time steam engine, it has kept step with progress through the years, now having one of the most modern and efficient Diesel generating plants to be found anywhere in the great Southwest. This new plant has enjoyed nation-wide recognition due to its outstanding record for economy established during the last four years.

As concrete evidence of benefits accruing to the citizens, taxpayers and electric power consumers of Greenville as a result of owning and operating their own electric and water plant, Mr. T. S. Mitchell, Utilities Commissioner of the city, furnished the following figures taken from operating reports and statements for the fiscal years of 1933-34 and 1936-37 in that order:

| | | |
|---|---|---|
| Gross kw. hr. generated | 5,281,110 | 6,471,750 |
| Total revenue | $146,420.82 | $192,941.44 |
| Total gross earnings | $62,861.78 | $130,224.38 |

It is interesting to observe that the city is receiving more than $100,000 a year from its utilities, almost three quarters of which is from the Diesel light and power plant. This fact is highly significant when one considers that Greenville has a heavy bonded indebtedness for schools and streets built in recent years requiring an assessment for sinking fund purposes of $2 per one hundred dollar valuation to take care of this financing and only $0.20 (twenty cents) for general purposes. The net earnings of the utilities furnish practically all the money necessary for general purposes and in the future, according to Mr. Mitchell, it is expected that these utility revenues will be sufficient to run the city without any taxation for general purposes. As previously shown, the earnings of the light and power plant have increased more than 100 per cent during the last five years and this is in addition to a total of $25,648.32 worth of free service rendered the city by furnishing power at no charge for the operation of water works and sewers.

In this connection, Mr. Mitchell cites a comparison of Greenville with a nearby town which does not own its utilities as follows:

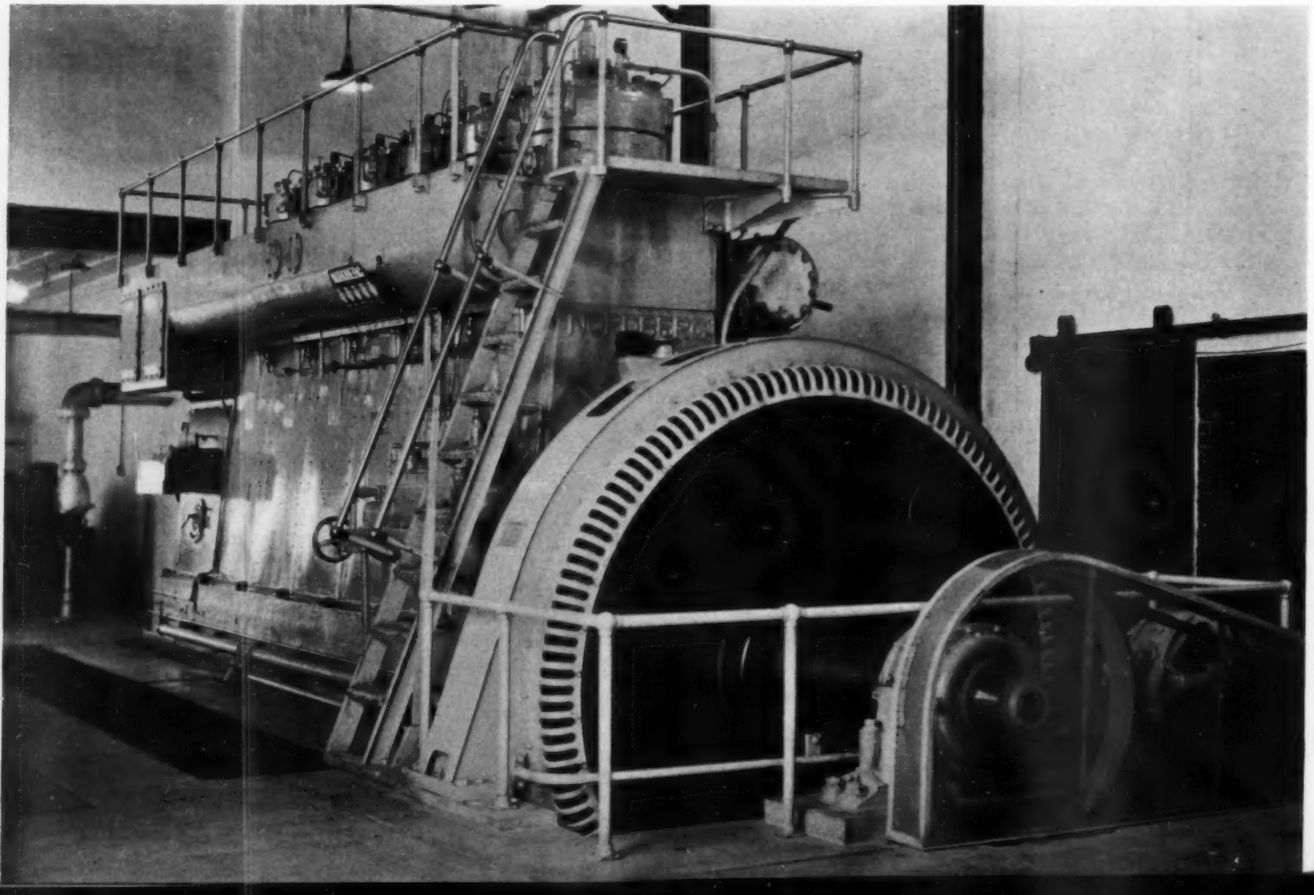


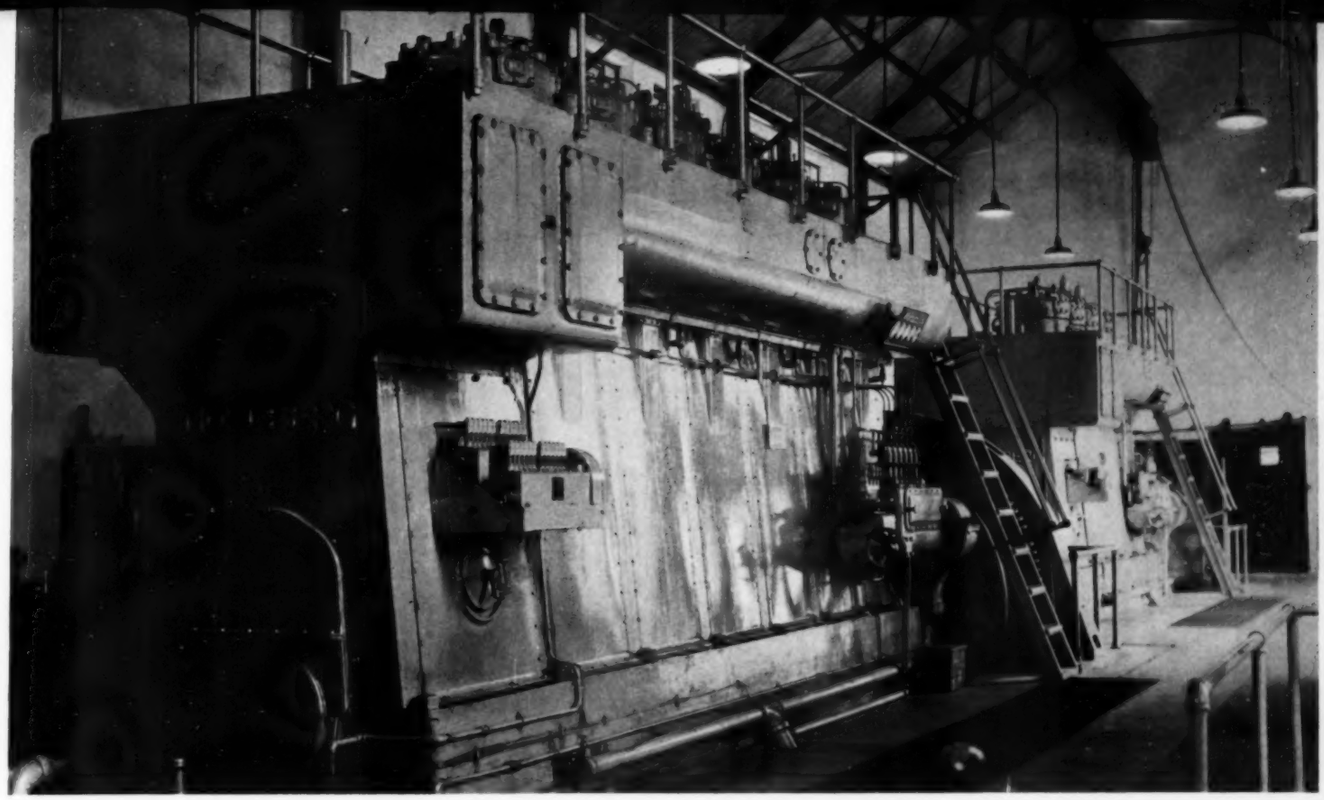
*Jacket water cooling for the Diesels is handled by this tower on a hill adjacent to the plant. Comparison with the children gives an indication of its size.*

"Let us compare the annual payments of a taxpayer living in Greenville in a four room house assessed at $800 and using monthly 40 kw. hr. of electricity and 3,000 gallons of water with those of a similarly situated citizen of a neighboring town where a privately owned company operates the light and power system. The annual saving to the citizen of Greenville is $13.40 despite the somewhat higher taxes."

Diesels first entered the picture at Greenville in 1933 when two Nordberg, two cycle, solid injection units of 1,000 and 1,450 hp. capacity respectively were installed with correspondingly rated Westinghouse generators. The General Electric switchboard carries, along with the usual power plant instruments, a recording kilowatt-hour meter and an Alnor pyrometer which serves both engines through ten thermocouples, four for the smaller Diesel and six for the larger, corresponding to the number of cylinders of each. Starting air is supplied by one motor-driven and one engine-driven Gardner-Denver compressors. The engines are protected by American Air Filters for intake air and DeLaval centrifuges on both fuel and lubricating oil lines. Since 1933, the demand for electric power has steadily increased to practically full capacity as indicated by the accompanying load curves. In the past, peak load and standby demand has been served by two turbogenerators. However, these will be taken off this year because the city has just purchased a third Nordberg Diesel of 2,000 hp. for this purpose. This installation is based upon the projected load demand from the two previous years. Throughout their operation the Diesels have been operated at a constantly high load factor. By shifting the engines twice daily the average load has been better than 75 per cent of total capacity and never less than 50 per cent.

As shown in the illustrations, the new plant is exceptionally well laid out for efficient and convenient operation. Practically all of the auxiliary equipment such as pumps, compressors, coolers, etc., are grouped around the engine foundations in the basement. On the main floor the switchboard is located opposite





*These two Nordberg Diesels of 1,000 and 1,450 hp. have served Greenville since 1933.*

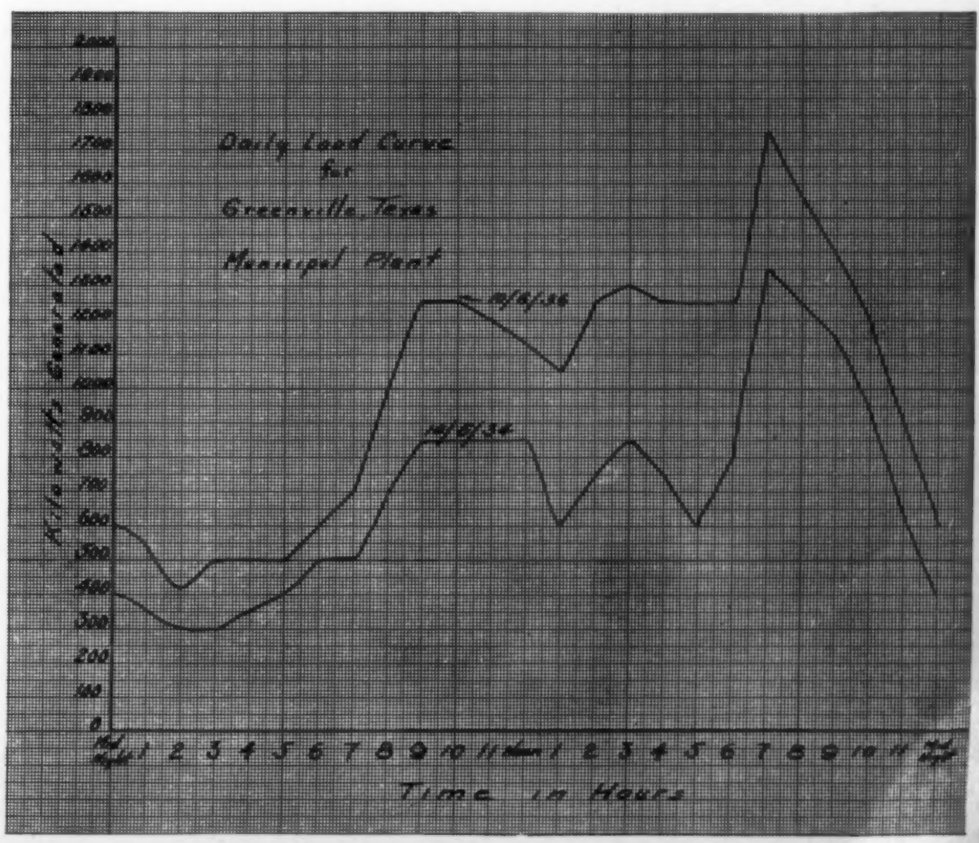
the 1,450 hp. Diesel midway of the building. A single bus with the necessary dead front type switches is installed behind the board in an alcove. Chain and cable controls operate the field rheostats in the basement.

The cooling system comprises a single circuit, atmospheric type cooling tower placed on a hill about 300 feet from the plant. Jacket water flows to a sump near the engines and is pumped to the top of the tower. There are by-passes on this line for diverting water to the fuel oil storage and day tanks if desired. Cold water from the tower flows by gravity to the circulating pumps and then passes through the oil coolers and engine jackets at the proper pressures. City water under control of a pressure operated valve is available for emergency cooling in case of pump failure.

From a financial standpoint, the Greenville Diesel installation is most satisfactory. Not only have the first two units paid for themselves in less than four years but the sum of $40,000 is available to apply toward the third engine. The balance will be made up from savings in a very short time. The plant will then be able to supply sufficient funds to the city to cover all normal operating expenses.

A final point worthy of note is that the first two engines have required no major repairs in four years of continuous operation and maintenance costs have been extremely low. In fact, according to the ASME power cost reports, charges for fuel, lubricating oil and repairs at Greenville are among the lowest on record. Overall cost of current at the switchboard has been well under four mills per kilowatt hour.

The order for the third and latest Nordberg Diesel, previously mentioned, was formally issued on or about June 15th last. It is uniform in cylinder size, type, and speed with the two existing units. Like them, it is a solid injection, two cycle engine with a Westinghouse generator directly connected. From the standpoint of operation and maintenance this uniformity is highly desirable, since it does not complicate the storage or materially increase the capital investment in spare parts carried on hand at the Greenville plant. Likewise, the operating personnel will not find it necessary to deviate from previous routine.



# TURBULENCE IN TWO STROKE CYCLE DIESEL ENGINES

*By* B. J. VON BONGART

TURBULENCE, or rather a continuous rotary motion of the air charge during the compression stroke, is indeed desirable. Its effect manifests itself in various ways, such as reduced ignition delay, lower fuel consumption, lower piston temperature, cooler exhaust and greater all-around efficiency. For 2 stroke cycle engines, however, the full realization of sufficient turbulence is not easily obtainable.

The usual 2 stroke cycle engine with intake and exhaust ports *vis-à-vis* represents an arrangement not conducive to realization of the very maximum of turbulence. The customary placement of the ports is shown in Fig. 1.

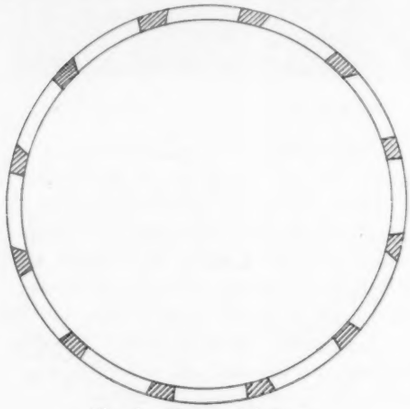


*Fig. 1. Tangential ports.*

As will be seen, the intake as well as the exhaust port consists of a number of vertical slots beveled towards the inner side. The beveling of the slots will produce a circulatory motion of the incoming air charge, but, since the outgoing exhaust gases are in such close proximity to the incoming air, the former cause interference and are also bound to mix to a greater or less extent with the incoming air, thus polluting the air charge. Yet in spite of it all, a certain amount of turbulence is thus obtained, but not as much as is generally supposed. Just how orderly and well behaved incoming air and outgoing exhaust is expected to be, is depicted in Fig. 2.

Since the exhaust port is uncovered by the piston earlier than the intake port, the pressure within the engine's cylinder has diminished to but a few pounds above atmospheric when the intake port is uncovered, and the incoming air charge does not meet excessive resistance. But what degree of turbulence may be imparted to the incoming air charge is a moot question. There are various theories abroad as to how the incoming air charge and the exhaust are supposed to act; a typical conception is shown

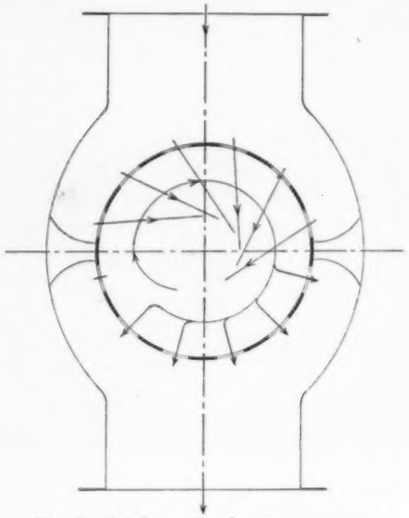


*Fig. 2. Intake and exhaust movements.*

in Fig. 3. While this illustration depicts the flow within a double-acting 2 stroke cycle engine, it is assumed to be similar to this within the usual single-acting 2 cycle engine.

In this illustration, "A" represents the upper side of the piston, "B" the lower side. The intake and exhaust headers are common for the upper as well as the lower part of the cylinder.

Among others, Sass* has done considerable research work in connection with 2 cycle engines, and has endeavored to record the phenomenon of turbulence by scientific means. In so far as 2 stroke cycle engines are concerned, the quintessence of turbulence is a well regulated, orderly, and relatively constant circular motion of the incoming air charge. For the experiments, Sass used a glass cylinder of dimensions corresponding to actual engine size, and the ports were exact duplicates of those embodied in an actual 2 cycle engine. The machinery set-up is shown in Fig. 4, consisting essentially of a motor-driven blower and the necessary piping for the delivery and expelling of the air. As can be seen, in the center of the glass tube (the equivalent of an actual engine-cylinder) is a vertical post, supporting a number of horizontally disposed arms, to which wool strings are attached. In order to determine the air velocity and pressure, a number of Pitot-tubes are fitted at various points, permitting exact recordings. Whenever the turbulence — or rather the circulatory motion — of the air is "orderly," then the wool strings will be practically stationary, whereas if the motion of the air is erratic, the strings will flutter, clearly indicating that all is not well. Photographic reproduction of the phenomenon is shown in Figs. 5 and 6. The former shows the action of the air at moderate rotative speed, the latter at high speed.

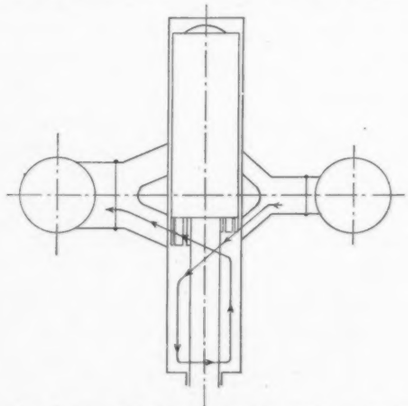


*Fig. 3-A. Turbulence, double-acting 2 cycle engine.*

*Dr. F. Sass, of the A.E.G.

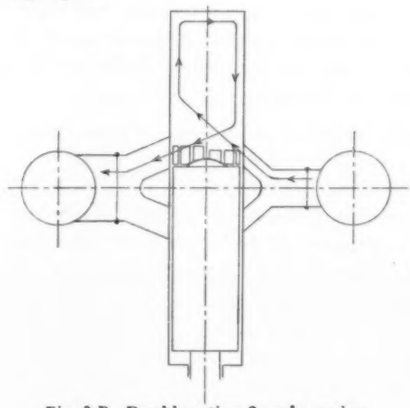


*Fig. 3-B. Double-acting 2 cycle engine.*

For double-acting 2 cycle engines (design as per Fig. 3) the results obtained are very similar to those depicted in Figs. 5 and 6. Of course, in all double-acting engines, the combustion chamber — upper and lower — are dissimilar in cubical content, due to the piston-rod leading to the crosshead; and also, a certain amount of impediment in the way of an even air-flow is caused by the said piston-rod. Just how the air-flow circulates within a double-acting engine is shown in Fig. 7.

At "A" we have the lower side of the piston. Within the center of the glass container is simulated the equivalent of a piston-rod, which in turn supports horizontal sticks carrying the wool strings. At "B" we have the upper side of the piston; here the glass container carries merely a center post to which horizontal rods are fastened as supports for the strings.

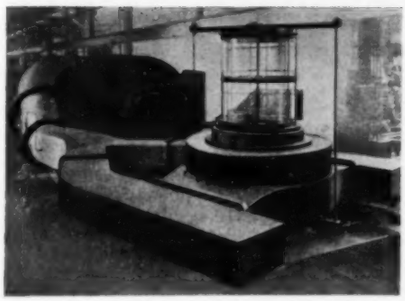


*Fig. 4. Testing apparatus, determining turbulence.*

Comparing the black lines (wool strings) of "A" and "B" we note that the air-flow at the upper side of the piston is more violent than on the lower side. The strings in the former case are bent at a more acute angle than in the latter. Also, for the upper side of the piston, the strings are somewhat evenly disposed and fixed within the rotating air-stream, whereas at the lower side of the piston, the strings are rather "bunched together," due undoubtedly to the interference caused by the comparatively large piston-rod. For convenience sake, the port layout of double-acting 2 cycle engines is identical for the upper and lower half of the cylinder. While this simplifies the machining operations in manufacturing, finesse in designing would dictate that the layout of the ports of the lower half of the cylinder be influenced solely by a desire to obtain well-matched performance.

It must be borne in mind that the photographic reproduction of the behavior of the wool strings does not record the actual movement of the air-stream or streams, but rather the effect

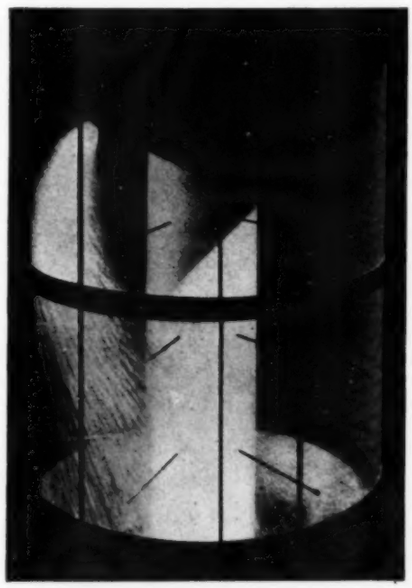


*Fig. 5. Rotating air-stream, moderate velocity.*

upon the suspended strings. By dividing the intake ports, feeding air to some and black smoke to others, the flow and the eventual complete "mixing" of the two can be recorded by means of a motion-picture camera. Surprising results are obtained when tiny phosphorescent bodies are mixed with the incoming air-charge; in a darkened room, a motion-picture camera will faithfully record the entire phenomenon.

In all of the foregoing, we have dealt with what amounts to a stationary piston, but since, in an actual engine, the piston perforce must move, a great deal of the air-gyrations thus recorded cannot take place because the upward moving piston interferes and the ensuing com-

*Fig. 6. Rotating air-stream, high velocity.*

pression places definite limitations upon the rotating air-stream. To determine the degree of turbulence – rotary motion as well as velocity – within an actual engine, an arrangement as illustrated in Fig. 8 will come closest to actual performance.

A vane (1), free to revolve, is fastened to the rod (2), which in turn actuates a lever arrangement (3) operating a stylus. The stylus records upon a strip of paper. As the piston moves up and down at a given velocity and the paper roll beneath the stylus also travels at a given speed, exact recording can thus be made. By synchronizing the speed of the piston with that of the paper roll, definite values of air-stream motion within the engine's cylinder can be established. The stylus will indicate the motion of the air-stream as well as its velocity during the various stages of the suction and exhaust strokes, and will also indicate what degree of motion, if any, the air possesses at T.D.C. (the point of maximum compression, when fuel would ordinarily be injected and combustion would begin). If the compressed air retains a semblance of motion, it is an indication that the ignition delay will be of short duration and that the flame propagation may be reasonably rapid. Since these two factors – other things being equal – control the power output, the efficiency and general desir-

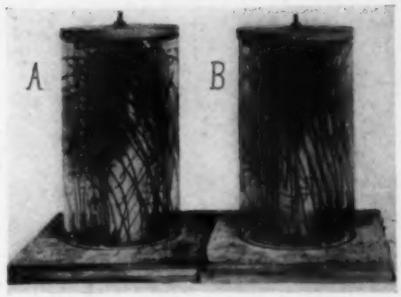



*Fig. 7. Rotating air-stream, double-acting 2 cycle engine.*

ability of any given engine design, it is manifest that since turbulence provides for efficiency, it should receive the attention it deserves.

Of course, all 2-stroke cycle engines having intake and exhaust ports facing one another are subjected to mutual interference. In the uni-flow 2 cycle engine (i.e., an engine where the intake ports only are located near B.D.C. of the piston and the exhaust is expelled via a piston-controlled port near T.D.C.) a better air flow and far greater turbulence may readily be obtained. As many as six complete spirals of whirling air have been recorded in a test cylinder having a "stationary" piston (as in tests, Figs. 5, 6 and 7), as shown in Fig. 9.

The great – if not the greatest – feature of the uni-flow construction is that the incoming air-stream can be thus utilized as a means for piston cooling, a characteristic of prime importance. In the common 2 cycle engine with opposed ports, the expelling of the exhaust gases heats the piston unduly, and the inrushing air-stream cannot possibly cool the piston head, much less counteract the heating im-

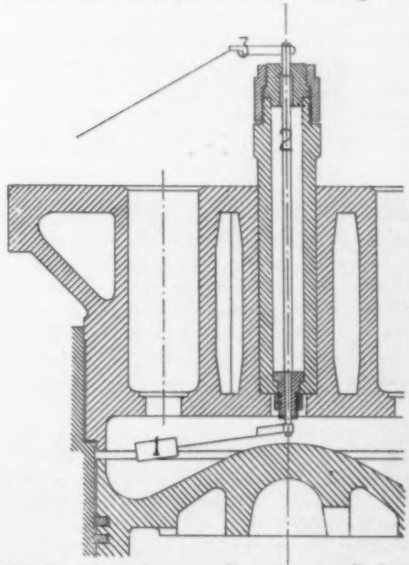



*Fig. 8. Air-motion recordings in test-cylinder.*

parted to the piston by the burning exhaust gases which pass over the piston-head during their exodus via the ports.

. . . . *And now please turn to page 52*

Courtesy U. S. Bureau of Mines.

*Above: Airplane view of the U. S. Bureau of Mines Helium Plant near Amarillo, Texas. Below: Interior of the helium separation building, where the helium is extracted at 310° F. below zero.*

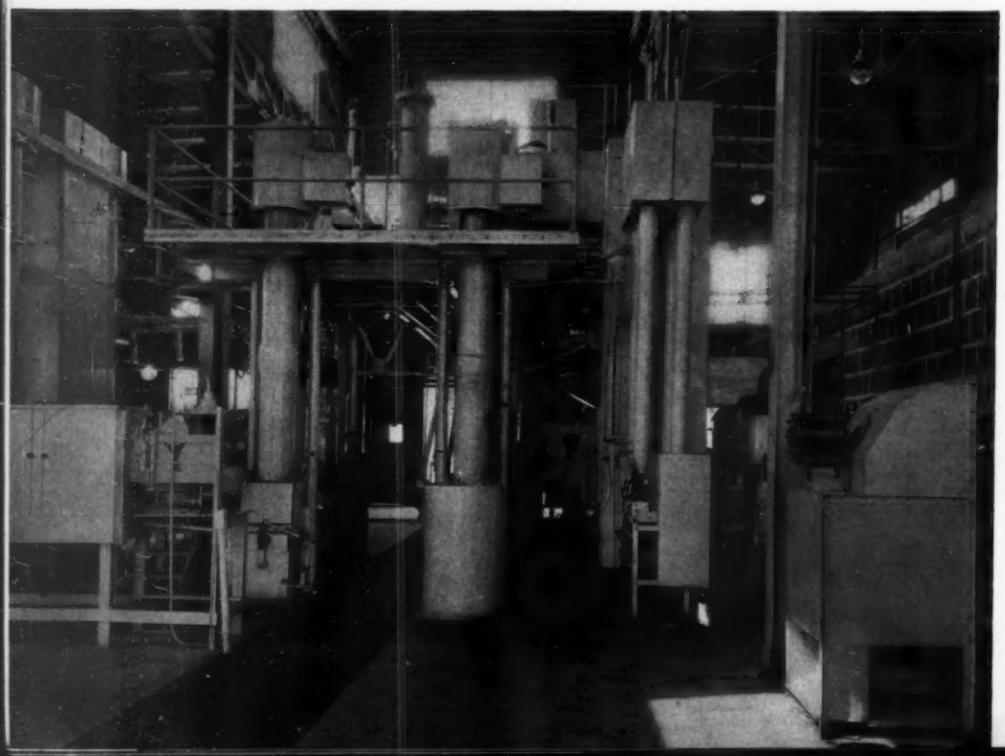
# HELIUM AND THE AIRSHIP DIESEL

*By* PAUL H. WILKINSON

THE airship Diesel depends for its future existence upon the same substance as does the Zeppelin, namely, helium. Without helium it is safe to say that there will be no more commercial Zeppelins and, therefore, no need for airship Diesels. Recently there has been so much controversy on the subject, that a brief and authentic* survey of the helium situation doubtless will be of interest.

The use of helium for airships is not a new idea by any means. In his book, "Up Ship!" published in 1931, Commander Charles E. Rosendahl, U.S.N., the leading authority on the operation of lighter-than-air craft in this country, states:

"Each disaster involving a hydrogen-filled airship has forcefully drawn attention to the subject of helium . . . it cannot, even in the chemical laboratory, be made to combine with any



*Right: U. S. Army Air Corps tank car for helium transportation. The three steel cylinders have a total capacity of 200,000 cu. ft. (Courtesy U. S. Bureau of Mines.)*

other element. It is, therefore, non-inflammable, non-explosive—a perfectly safe medium. . . . Helium thus far, initially costs more than hydrogen; but considering that with little loss we can inexpensively repurify helium several times, and that under similar conditions we must supply new hydrogen each time, we find that in addition to the virtue of perfect safety, the cost advantage in this respect lies with helium. . . . In my opinion, we should forget the hydrogen standard from now on and use the performance of the helium-inflated ship as our standard for comparison."

Commander Rosendahl's statements were based on his own experience, for it was due to this non-inflammable lifting gas that he and a number of the crew of the *Shenandoah* were able to survive when this American-built airship broke up in the air and was wrecked in 1925.

Turning to the history and production of helium, we find that in 1868 this remarkable gas was discovered in the spectrum of the sun, whence its name from the Greek word "Helios" for the sun. It was not until 1895 that it was detected on the earth in the form of an inert, colorless and odorless gas obtained from radioactive ore. Prior to 1917, helium was obtained only in small quantities as a curiosity in scientific laboratories, costing as much as $2,500 per cu. ft. When the United States entered the World War, however, the demand for an inert gas to replace the explosive hydrogen used in observation balloons and airships led to intensive development work by the Bureau of Mines, in conjunction with the Army, the Navy and the Linde Air Products Co. Much of the work was done in the Cyrogenic Laboratory of the Bureau of Mines, which, on account of its

*Commander Charles E. Rosendahl, U.S.N., in charge of the U. S. Naval Air Station at Lakehurst, N. J.*

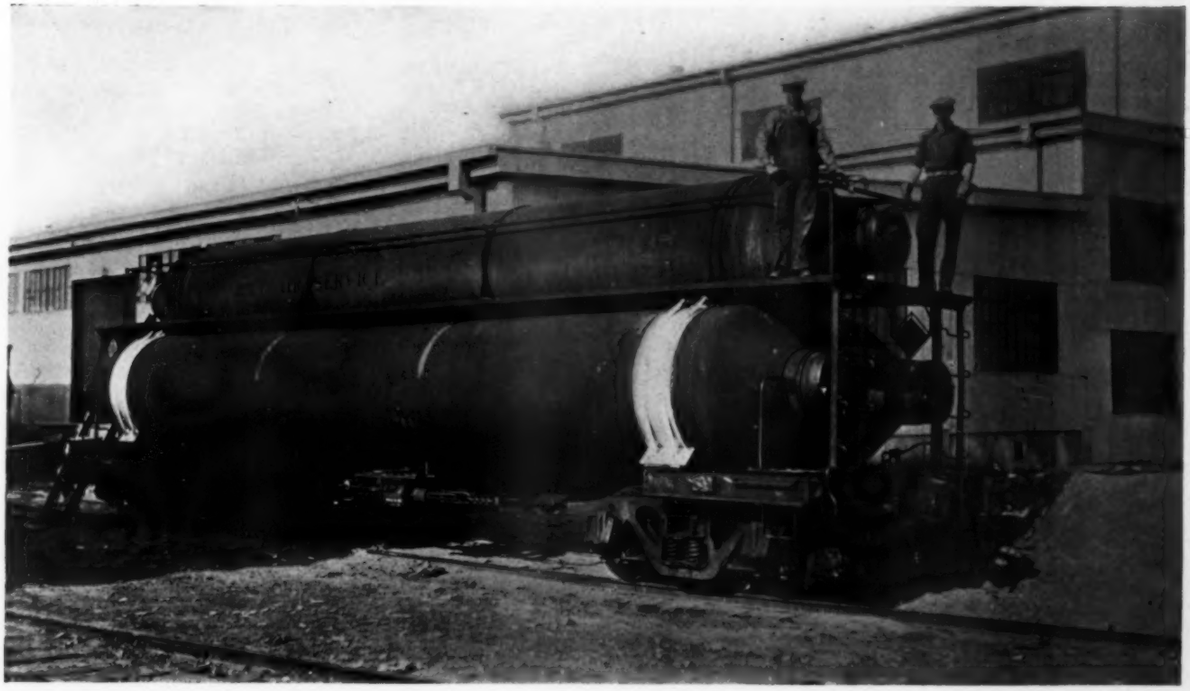
research work at extremely low temperatures, has been called "the coldest spot in the world."

Today the United States has a virtual monopoly on helium, as it is the only country so far in which it has been found in appreciable quantities. Most of it comes from natural gas wells on the government-owned Cliffside structure near Amarillo, Texas, where 50,000 acres of land have been reserved for its production. The helium-bearing gas sands, lying at a depth of 3,600 ft., are conservatively estimated to contain 1,800,000,000 cu. ft. of the precious element. There are other government reserves at Woodside and Harley Dome in Utah, where 600,000,000 and 100,000,000 cu. ft., respectively, lie undeveloped as a safeguard for our national defense.

The Bureau of Mines extraction plant, located near Amarillo, utilizes the natural gas piped to it from wells on the nearby Cliffside structure. There the natural gas has its hydrocarbon contents removed and is cooled to 310° F. below zero, at which temperature all the other constituents are liquified and the helium is drawn off as a gas. The residual gas, when it re-forms without the helium, is then piped to the City of Amarillo, where it is sold for heating purposes.

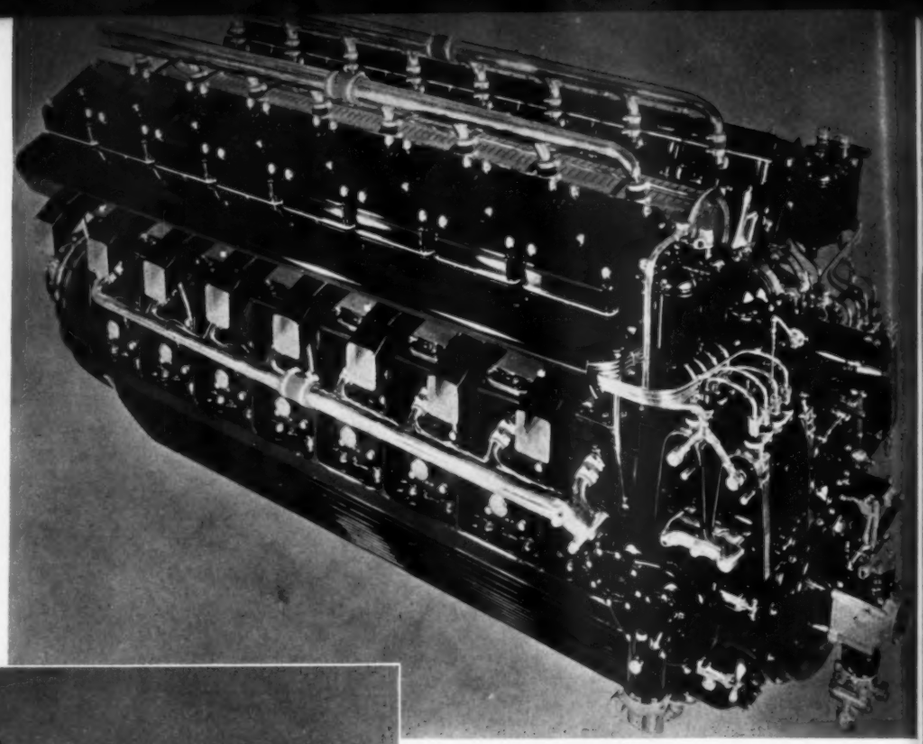
At the extracting plant storage facilities are provided for 3,500,000 cu. ft. of helium in steel cylinders under a pressure of 1,500 lb. per sq. in. When it is to be shipped, it is compressed into small cylinders of the oxygen type containing 178 cu. ft. of helium at a pressure of 1,800 lb. per sq. in.; or into three larger ones constituting a tank car lot and containing a total of 200,000 cu. ft. of helium at a pressure of 2,000 lb. per sq. in.

So much for the production of the helium. Its use in an airship entails specific problems, one of which is the slow but constant diffusion of air into the gas cells, and of the lifting gas out into the atmosphere. This gradually contaminates the gas as well as reduces its lifting power, making it necessary to empty the cells and replenish them at frequent intervals. If the airship is filled with hydrogen, this may



have to be done several times a year, and the gas then has to be discarded, as it is far too dangerous to try to purify such an explosive mixture. Helium, on the other hand, has the advantage that its rate of diffusion and contamination is much slower and, furthermore, it can safely be drawn off from the gas cells, purified at a low temperature and replaced in the airship. Since the cost of new hydrogen is greater than the cost of purifying the helium, the use of the latter entails a considerable saving.

Although helium is much lighter than air, it has only 92.6 per cent the lifting power of hydrogen. The latter can lift 71.0 lb. per 1,000 cu. ft., while the same amount of helium will only lift 65.8 lb. This difference in lift is quite appreciable when it is borne in mind that the latest type of Zeppelin has a capacity of 6,710,-



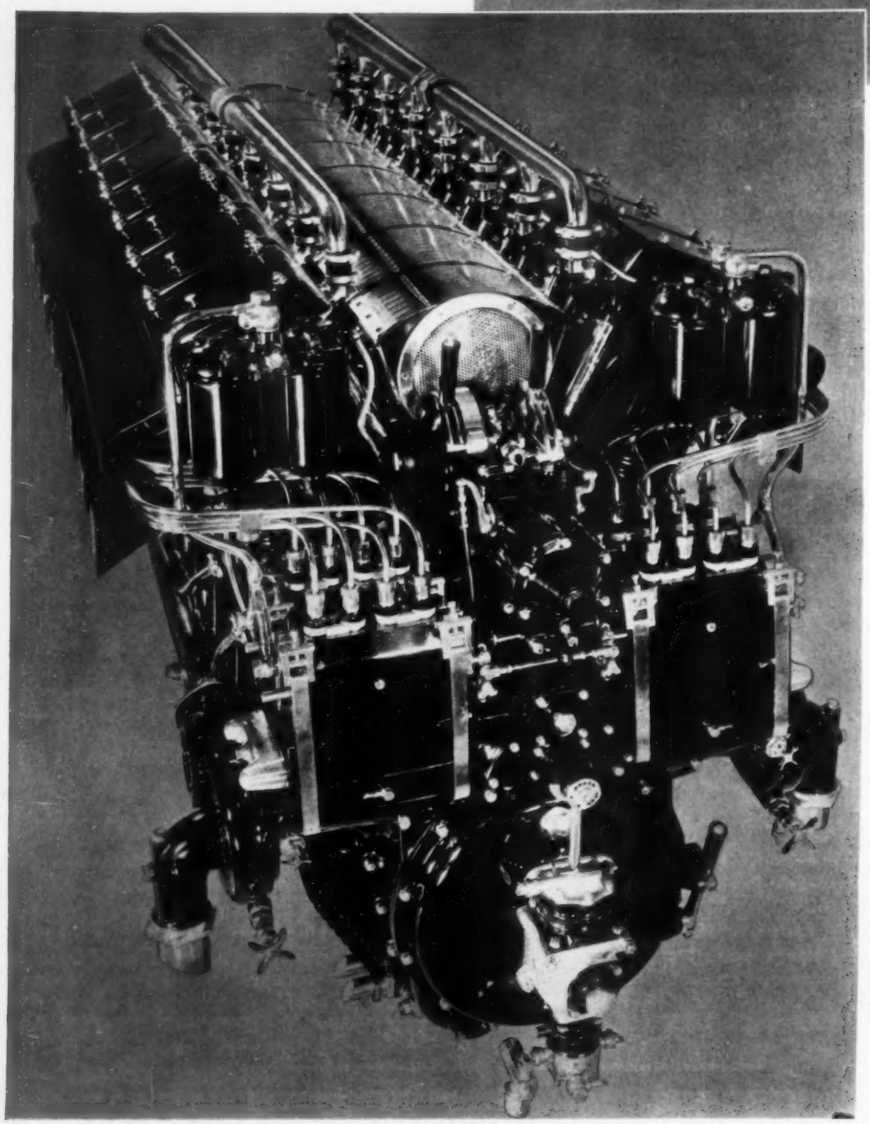
*A beautiful piece of machinery! The latest model Mercedes-Benz "LOF-6" airship Diesel, rated at 1,200 hp.*

000 cu. ft., and the difference in lifting power then amounts to nearly 35,000 lb.

As to the cost of helium, it is estimated that this could be brought down to $4.00 per 1,000 cu. ft. provided the extracting plant could be operated at its rated capacity of 24,000,000 cu. ft. per annum. Helium at this price, or even at $5.00 per thousand, would be cheaper in the long run than hydrogen at $2.00 per thousand. At the $4.00 rate, the cost of filling an airship the size of the *LZ-130*, now nearing completion, would be approximately $27,000.

So closely guarded is helium, that before any can be sold or exported from the government reserves, permission has to be obtained from the President and the Secretaries of War. Navy and the Interior. This restriction was imposed to prevent its purchase by other countries for military purposes, and to conserve our national resources. Arrangements are being made, however, whereby an adequate supply of helium will be made available for commercial airships so that there will no longer be any risk to these giants of the air.

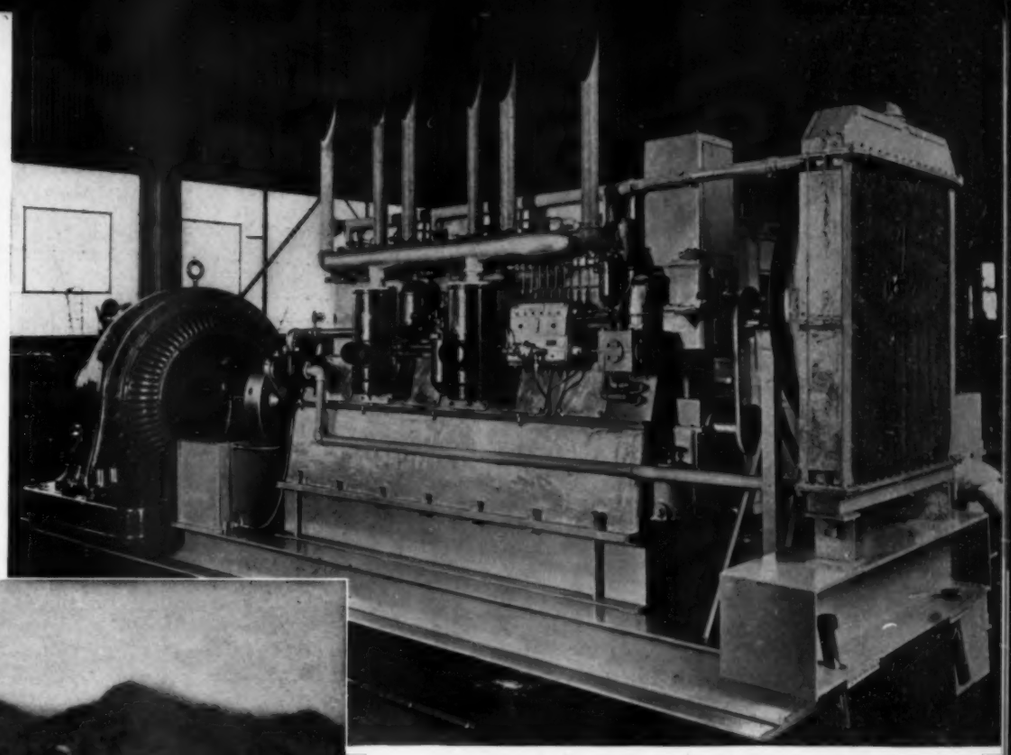
The fact that the lifting power of helium is slightly less than hydrogen need not be considered as a serious detriment inasmuch as the fuel supply on board could be reduced somewhat, or the size of the airship could be increased slightly, thereby eliminating any reduction in payload. All-in-all, it is therefore evident that there is much to be gained by the use of helium, both for economic reasons and for reasons of safety and that this non-inflammable and non-explosive lifting gas is the only means whereby lighter-than-air development can progress in the future.

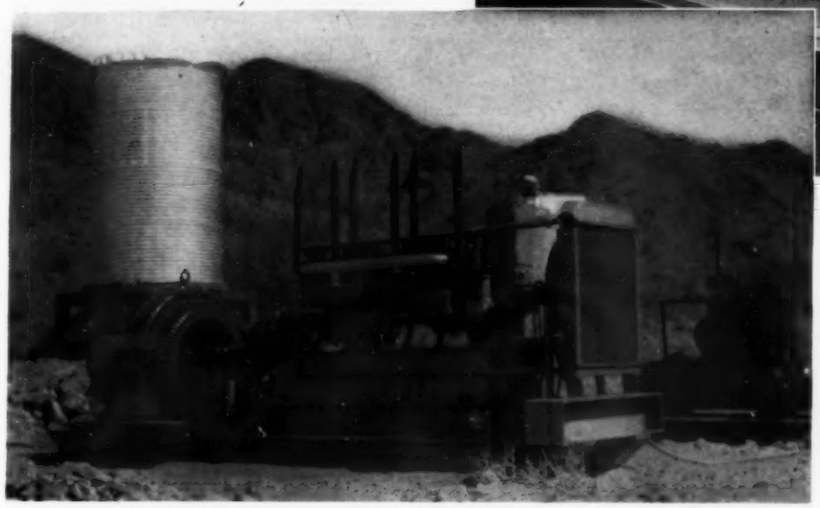


*Rear view of the "LOF-6," showing the four fuel pumps, two-stage air compressor (for starting purposes), and the duplex fuel filters.*

*The information on helium contained in this article is based upon data supplied by the United States Bureau of Mines.

# DIESEL DRY LAND DREDGE





*The Western 150 kw. Diesel generator set just before shipment, and (left) "on location." This unit is pioneering in new mining methods and will soon be duplicated to take care of expanding operations.*

THE Morgan Concentrating Co. of Quartzsite, Arizona, recently took delivery of an especially designed Diesel generating plant that is the first of its type ever to be used in gold mining operations. It consists of a six-cylinder Western Diesel engine direct connected to a 150 kw. Allis-Chalmers 220-440-volt, 60-cycle alternator, both units mounted on a structural steel skid base that also carries the cooling radiator.

The use to which this portable generating plant will be put is quite unusual. The Morgan Company is an old time gold mining firm which has used probably every known means of extracting the metal from the ground. At the site of the present operations there is no water supply, and furthermore, the land has previously been worked by miners and any nugget gold already removed. They are, therefore, operating on the "dry placer" principle and through the use of vibrator screens and specific gravity they are able to extract more gold from tailings than the original prospectors took from the virgin soil. A gasoline powered shovel that is shortly to be converted to Diesel is used to dig and dump its load into the first unit of the plant. At the present rate of operation a swath about 30 feet wide and 1,000 feet long will be dug each six months by the shovel. As it is moved the electric driven gold extracting equipment is moved also with the shovel. The Diesel generating plant is equipped with a switchboard and from it there is a 500-foot length of flexible armored cable running to the machinery. The entire plant may be termed a "dry land dredge."

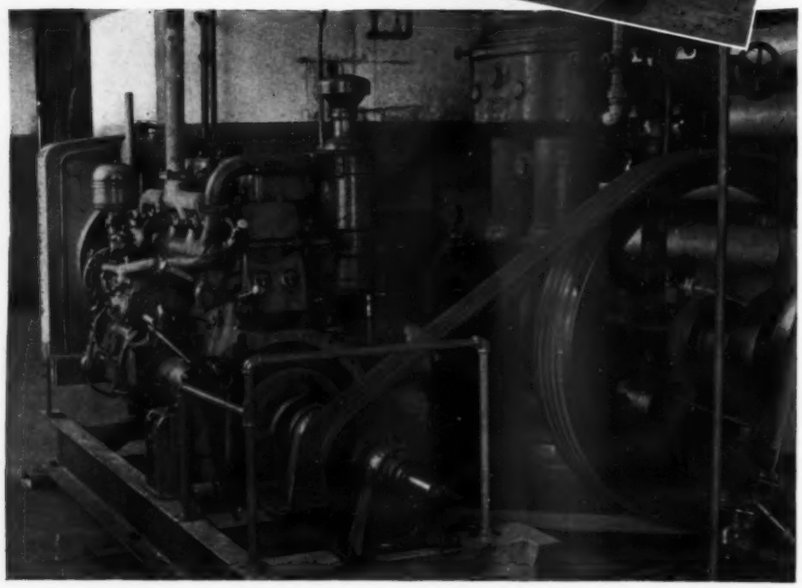
The Western type DS Diesel is one of the latest developments of the Western Engine Corp., Los Angeles, and the engine features total enclosure of all moving parts. It has a bore of 7¼" and a stroke of 8"—with a maximum operating speed of 900 rpm. Bosch fuel system is used—and a Woodward model C hydraulic governor maintains accurate speed regulation. Accessories on the engine include two Vortox air cleaners, Cuno lubricating oil filter, and a Groco lubricating oil cooler. Between the Diesel and the generator is a 50-gallon fuel oil tank which is replenished by a tank truck, owned by the firm. Starting is by air through a disc type distributor. The gasoline engine driven air compressor and air storage tank is mounted on a separate steel base.

The capacity of the dry land gold miner is approximately 80 tons per hour. Considerable of the diggings include solid rock, because the shovel takes not only the loose soil that is six to ten feet in depth, but also from 18 inches to 24 inches of the granite. All solid rock is disintegrated before it is carried by a belt conveyor to the vibrating screens.

Pending a few months further experiment with the entire plant, the Morgan firm expects to build a number of similar plants. There being no precedents established for this form of gold mining, it has been necessary for them to design and build all of the equipment for this specific work—and the results obtained to date indicate that they have found a highly successful means of obtaining gold that could not otherwise be reached.

The Western Engine Corporation are celebrating their 50th anniversary this year and are the oldest builders of Diesel and natural gas engines on the Pasific Coast.

*When the guest orders ice at this hotel in Corpus Christi, Texas, it will henceforth come from the Diesel operated plant shown at the right. The change from steam to Diesel was prompted by economies which paid for the change in a little over a year's operation.*



# HOTEL NUECES' DIESEL ICE PLANT

WHEN temperatures soar elsewhere, the Gulf of Mexico is an ideal vacation spot, and Corpus Christi, Texas, gets its share of the summer tourist trade.

Fishermen, swimmers, golfers and other sportsmen and sportswomen make their headquarters at the big Nueces Hotel, one of the city's finest. During their stay here, Diesel power adds considerably to their comfort and contentment.

To the summer vacationist the long, cool drink that follows the tennis or golf game is an important pleasurable item. It refreshes and adds to his stamina. At the Neuces Hotel a Diesel engine makes these drinks possible.

Operating 24 hours a day during the vacation season, a Caterpillar 66 hp., four-cylinder Diesel is at work manufacturing ice for the hundreds of guests. The 16 and 17 ton output per day is more than the hotel can possibly use, and the balance is sold at a profit.

The engine is connected by V-belt to an 8″ x 8″ twin cylinder ammonia compressor. The compressor runs at 225 rpm. at a head pressure of 225 pounds and a suction pressure of 25 pounds.

The hotel ice plant was first run by steam. Later other power was used at a cost of $450 monthly during the busiest periods. Desiring more economical power, the management installed the Diesel, and the engine has lived up to all expectations. Out of savings over these former costs, the Diesel paid for itself in the short time of fourteen months.

Since its installation on June 1st, 1935, the engine has run well over 10,000 hours and has given remarkable service. Although its operating schedule is constant during six months of the year, and it runs from eight to ten hours a day during the other six months, maintenance costs have been negligible – not more than $25 have been spent for upkeep!

Taken over a period of a year, the engine operating costs, including fuel and lubrication, have averaged $80 per month. In other words, it costs the Nueces Hotel only 26 cents to operate its engine in producing one tone of ice. Another example of typical Diesel economy.

# DIESEL ENGINES

*By* JOHN W. ANDERSON

## No. 5. COOPER-BESSEMER TYPES GN AND EN

COOPER-BESSEMER builds an extensive line of four cycle Diesel engines, but this article is concerned with only the two smallest cylinder sizes. Type EN has cylinders 8" by 10½" and the GN cylinders are 10½" by 13½". Both cylinder sizes are built in 3, 4, 6 and 8 cylinder units for general marine and stationary purposes with many other applications such as railway and oil field use. The basic design is the same in all cases, but some of the details and especially the list of attached auxiliaries, varies according to the requirements of the individual installation. This introduces some interesting features.

The builder claims four outstanding features for the basic design—the patented atmospheric relief fuel injection system, the through bolt construction, the cylinder head and cylinder liner design, and the patented wrist pin construction. The details of all of these are clearly shown in the sectional view of these engines.

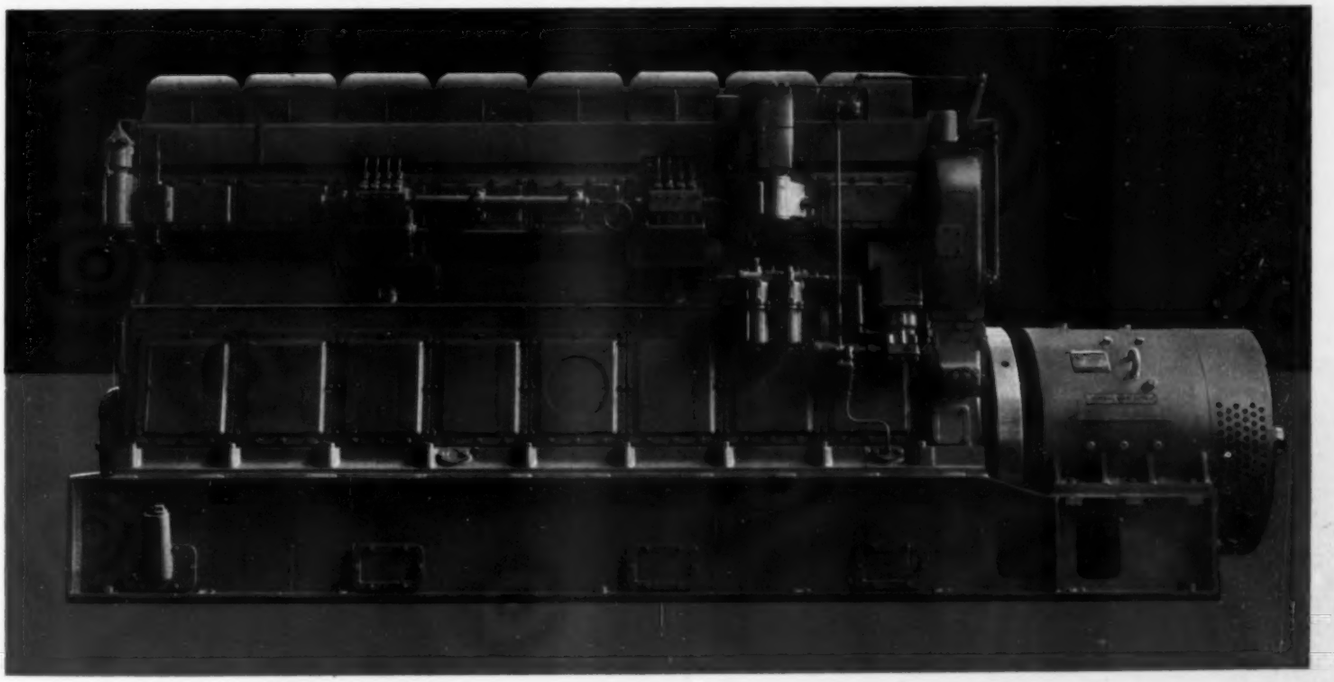
The fuel injection system is of the modified common rail type. There is the duplex fuel pressure pump with hardened and lapped plungers which delivers fuel at the injection pressure to the common rail. This pump has a capacity greater than what the engine can use even under overload conditions, and since it always delivers its full capacity according to the speed of the engine, the surplus not used by the engine must be cared for. This is done by the adjustable pressure regulating valve, which is set by the operator to maintain the proper injection pressure to suit the operating conditions, and which bypasses back to the fuel supply all surplus fuel. Fuel from the common rail flows to the atmospheric relief and timing valves, one of which is shown at the right in the engine section. There is one of these valves for each cylinder and they are grouped in blocks of three for three and six cylinder engines and in blocks of four for four and eight cylinder engines. These blocks are clearly shown in the general engine views bolted to the outside of the camshaft housing where they are readily accessible. The valves are actuated by cams on the special shaft just below the camshaft and driven from the latter by gears, as can be seen in the section.

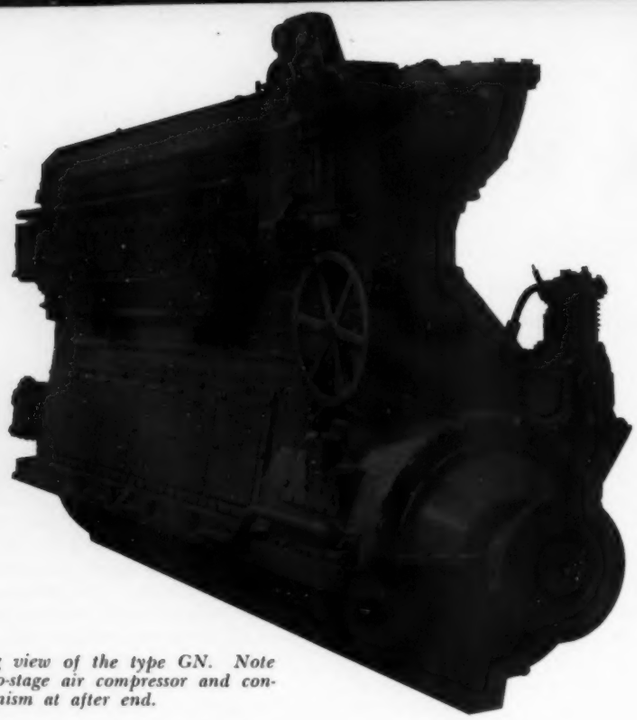
The function of these timing valves is to control the quantity of fuel injected to each cylinder, determine the time and duration of the injection, and most important of all relieve the pressure on the line to the cylinder in between successive injections. They are adjustable so that the load among the cylinders can be balanced, and this adjustment is not disturbed in any way by the removal of the cylinder head. As the section shows, the removal of the pipe between the timing valve block and the cylinder head does not disturb the timing valve in any way. The spray valve, in the center of the cylinder head, is simply a spring loaded check valve which prevents any gas leakage back into the fuel line.

As can be seen from the section, in between the timing valve and its cam there is a lever, and by varying the position of this lever the effectiveness of the cam can be varied and thus there is control over the lift and timing of the timing valve. This, with the injection pressure, controls the quantity of fuel. And when the timing valve is seated, the line to the cylinder is vented to atmospheric pressure, which gives a sharp cutoff to the injection and effectively prevents any possibility of dribbling, either at the conclusion of the injection period or between injections.

Many of these engines go into service applica-

*Type GN-8 generating set mounted on integral sub-base.*





*Quartering view of the type GN. Note built-in two-stage air compressor and control mechanism at after end.*

tions which call for a wide range in speed, and this common rail system gives excellent control over the entire range of speed and load.

The section shows the through bolts extending from under the bearings in the bedplate to the tops of the cylinder heads. There are four bolts in between each two cylinders at each main bearing, thus each cylinder head has its own four bolts or two for the main bearing on each side. The bolts are located as close to the main bearings as possible to relieve the bending load in the bedplate under the bearings. Thus the reactions from the gas loads are taken up directly between the cylinders and the main bearings, and the whole engine structure is held firmly together.

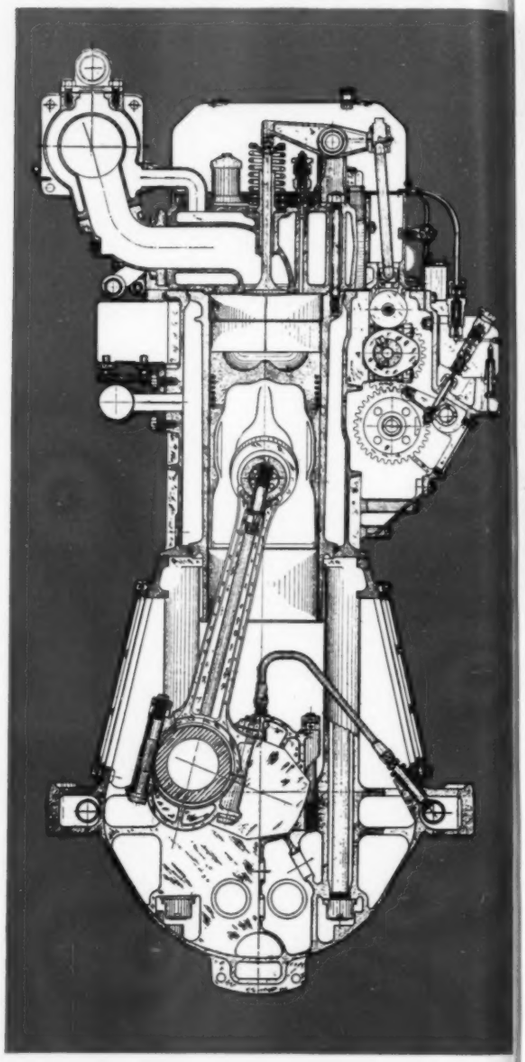
Note that the main structure of the engine consists essentially of the bedplate and crank housing in one piece, the cylinder block in a second piece, and the individual cylinder heads on top which are rectangular in shape and set closely together alongside of each other. This design enables the use of either semi-steel or aluminum alloy for the crank case and cylinder block according to the service application and weight limitations, without other change in design.

Combined with this construction is the third feature involving the cylinder head and cylinder liner design. The liner is a plain cylindrical piece bolted directly to the under side of the cylinder head by several long studs (one of them can be seen at the right in the section) extending through to the top of the head. The liner sets down into the cylinder block to form the cooling water jacket and to provide lateral support for the liner. The water joints at the top and bottom are made tight by rubber gaskets. This means of course that the liner can be easily removed from the block at any time by simply lifting it out with the cylinder head, or the head can be removed independently without disturbing the liner.

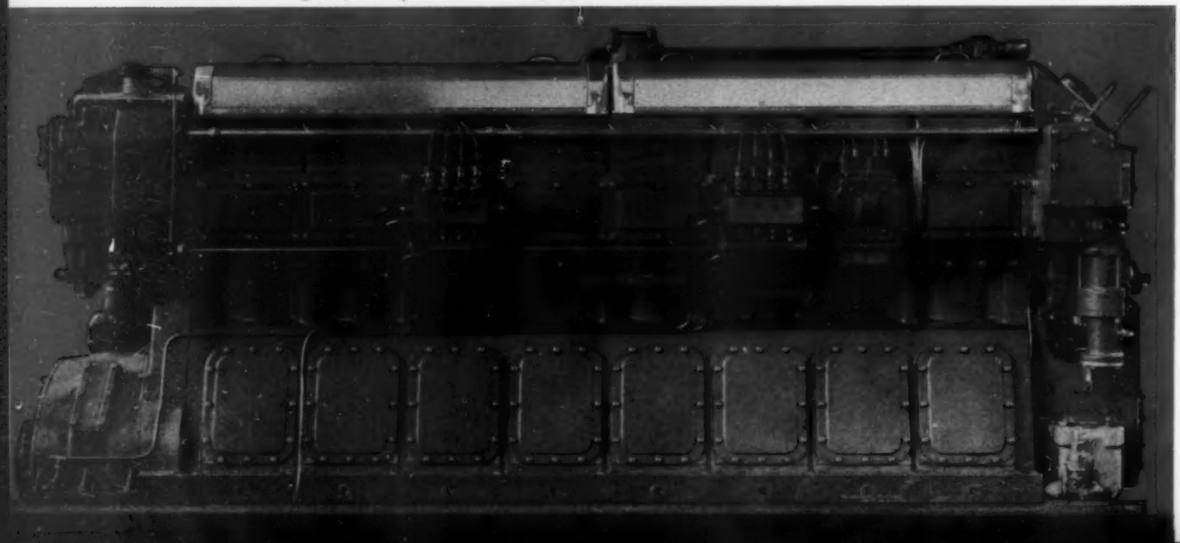
The special wrist pin construction consists of a hollow pin secured in a saddle at the top of the connecting rod by two alloy steel bolts (one is shown in the section) which are securely locked by a special device inside of the pin. The thought back of this construction is to provide the greatest possible bearing area for the gas loads downward from the piston, and this form gives the entire top area of the pin for a bearing. The piston bushings are shaped to extend entirely around the pin at the ends in order to provide bearings to take up the inertia loads on the exhaust and intake strokes.

The material for the pistons varies with the rated speed of the engine. Cast iron is used for the lower speeds and power ratings, and aluminum for the higher.

Many additional items are to be noted in the cross sectional engine view. There is the trough in the extreme lower part of the bed



*Eight cylinder, direct reversing type EN unit for marine service.*



*Above: Cross section of type EN which clearly illustrates the number of interesting features of design and construction referred to in the accompanying text.*

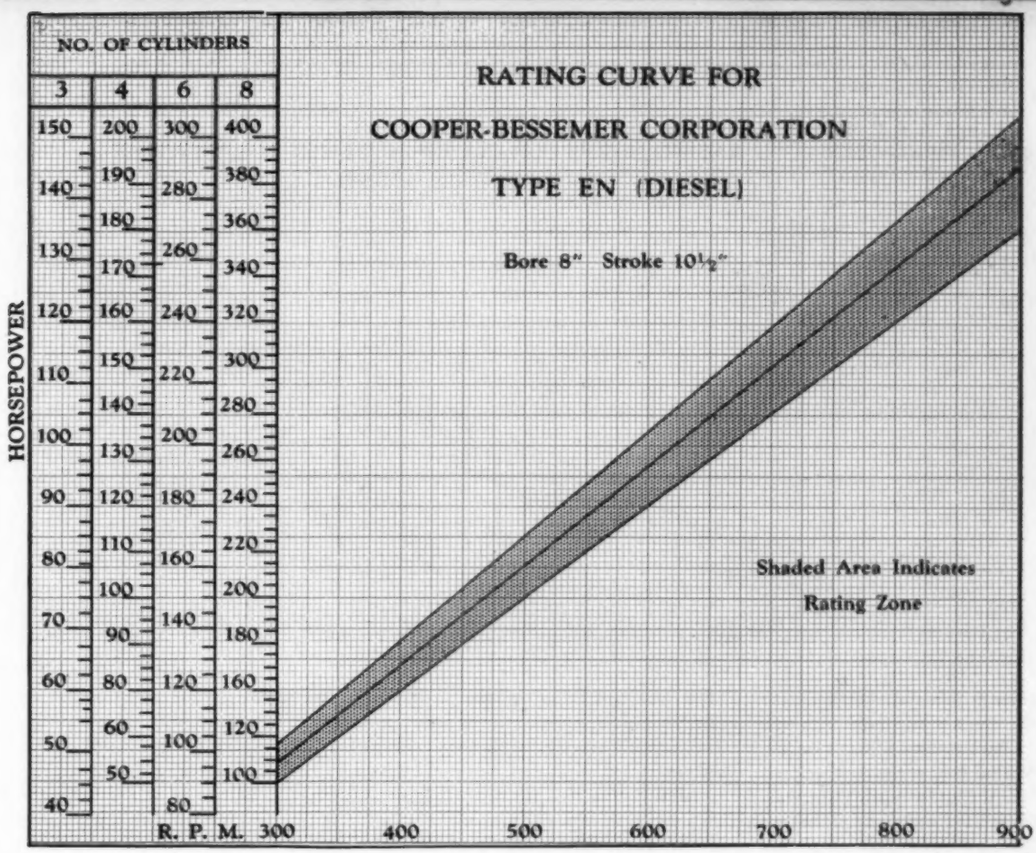


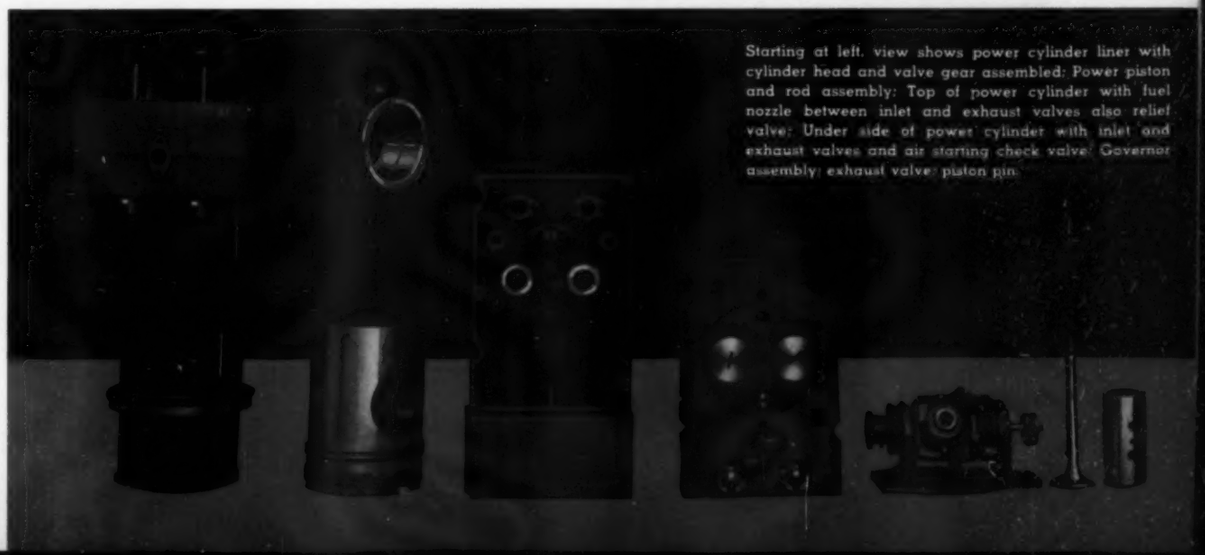

plate for draining off all of the lubricating oil to the separate sump tank, keeping the crankcase dry. The lubricating oil supply header is carried inside of one of the bedplates supporting flanges at the side, with branches to each main bearing.

The lower part of the main bearings and the upper part of the crankpin bearings are separate shells lined with babbitt, while the caps in both cases carry the babbitt in them. Shims are provided in all of these bearings to take up for wear.

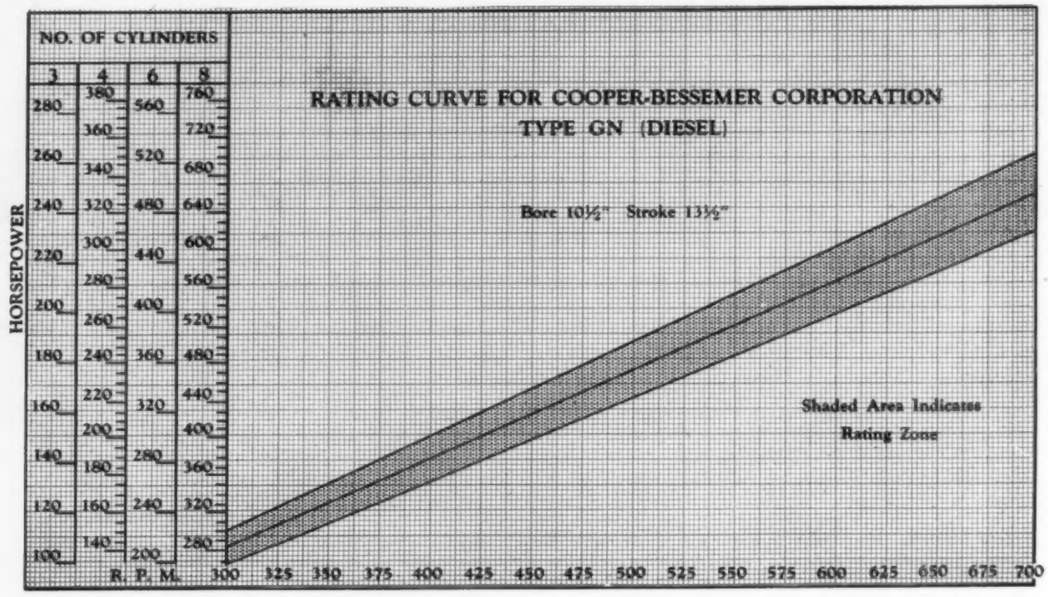
Intake and exhaust headers are on the back of the engine, and in some cases the intake header is made a part of the cylinder block casting. On the front of the engine there are the fuel timing valve and inlet and exhaust valve camshafts fully enclosed in a housing. The camshaft (the upper one for the inlet and exhaust valves) is driven from the crankshaft by a chain drive, adjustable for wear. The location of this camshaft at the upper part of the cylinder block makes possible very short push rods for the operation of the valves in the cylinder head. The arrangement of this mechanism and the guides for the lower ends of the rods are clearly shown. Oil tight covers enclose all of the gear on the tops of the cylinder heads. This enhances the appearance of the engine, keeps out the dirt, and permits one lubricating system to oil all parts, yet all parts are quickly accessible, when the occasion arises.

The lubricating oil pressure pump is at the end of the engine. Suction is from the sump tank outside, and delivery is through a strainer and cooler to the supply header. The crankshaft and connecting rods are drilled to carry the oil to the crankpin and wrist pin bearings. Note how the oil cooler is arranged on the back of the engine below the intake header to simplify the piping layout. A portion of the cooling water flows through this cooler on its way to the cylinder block.

*The Cooper-Bessemer through-bolt construction is well illustrated by this view of partly assembled engine.*



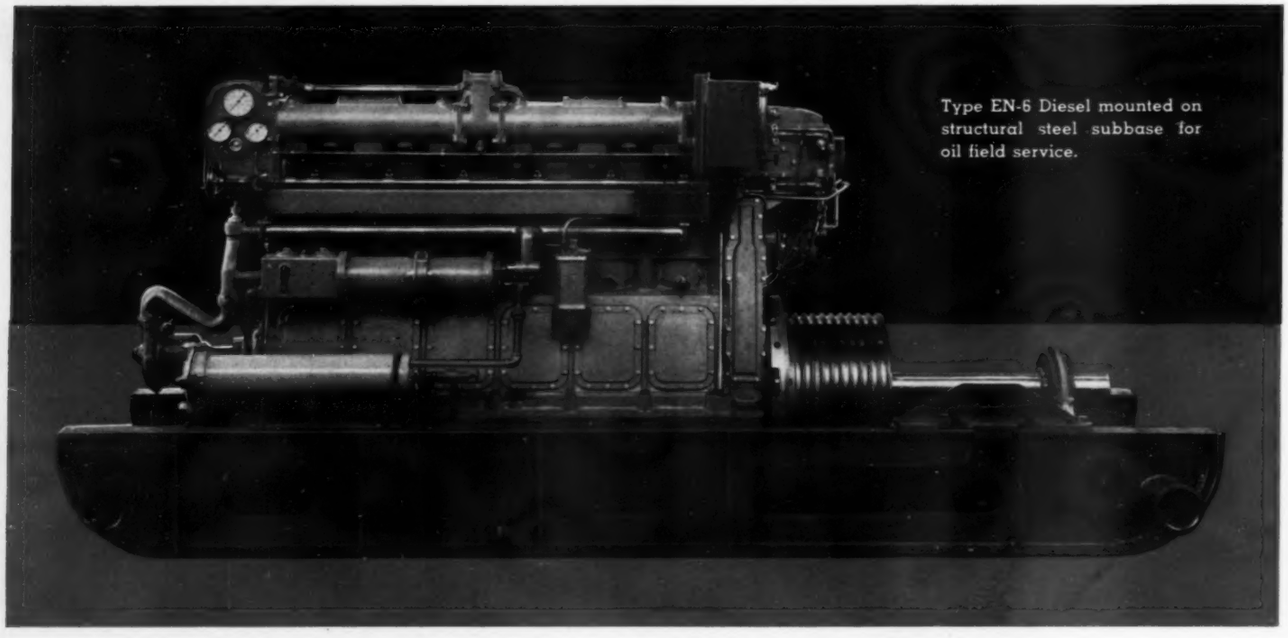
Starting at left, view shows power cylinder liner with cylinder head and valve gear assembled: Power piston and rod assembly: Top of power cylinder with fuel nozzle between inlet and exhaust valves also relief valve: Under side of power cylinder with inlet and exhaust valves and air starting check valve: Governor assembly: exhaust valve: piston pin.




When cooling water is not available from an outside source, the engines are fitted with attached pumps. This is usually the case in marine, railway and oil field applications. This pump may be of the centrifugal type and driven by the chain from the camshaft drive, or it may be a plunger type driven from the front end of the engine. As shown in the engine cross section, the water inlet header runs along on the back of the engine just below the air intake header, with a branch to each cylinder jacket space. The water flows around the cylinder liner and upward into the head jacket space, then up and out above the exhaust passage in the cylinder head, to the exhaust header jacket space. The latter acts as an outlet header for the entire engine.

The three and four cylinder marine engines are fitted with marine reverse gears, while the six and eight cylinder engines are made directly reversible. In the latter case the controls are concentrated at the forward end of the engine and consist of two levers. One of them controls the direction of rotation, and the other controls the starting air and the fuel, that is the speed. The engine is reversed by sliding the camshaft longtitudinally by a power cylinder at the forward end of the engine. The fuel injection pressure is controlled by a handwheel. Marine engines may also carry a plunger type bilge pump at the forward end, and perhaps a sailing clutch and a propeller thrust bearing at the after end. All marine engines have an attached starting air compressor driven through a plate clutch so that it can be cut in our out of action at will. Thus many of these marine engines are completely self contained power units. Similarly, engines are made self contained for other service applications, and may be mounted on skids for oil field service, as shown in the illustration.

The power curve plots show how the rating is varied to suit the operating conditions. For hard continuous duty, the lower parts of the curves are used; lower speeds and lower brake mean effective pressures. But where weight is an important factor and where the engine is seldom called upon to deliver its full rated power, then the upper portions of the curves can be safely used. Cooper-Bessemer engineers will gladly determine the exact rating figures to suit the individual case.



Type EN-6 Diesel mounted on structural steel subbase for oil field service.

## STATE COLLEGE PROGRAM ANNOUNCED

THE Program Committee of the Oil and Gas Power Division announces that the Technical Program scheduled for the Conference at Penn State College, August 18th to 21st, is determined, with the exception of several possible last minute additions. Papers which have already been definitely scheduled are as follows:

Progress Reports, by Diesel engine manufacturers and locomotive builders including statements by American Locomotive Company, Caterpillar Tractor Company, Davenport Besler Corporation, DeLaVergne Engine Company, Hercules Motors Corporation, Ingersoll-Rand Company, Nordberg Manufacturing Company and others.

The U. S. Navy Contribution to Diesel Engine Development, by E. C. Magdeburger, Bureau of Engineering, U. S. Navy Department.

Convertible Gas-Oil Engines, author to be announced.

Sewerage Gas Engines, by W. B. Walraven, Springfield, Illinois, Sanitary District.

Oil Flow Through Fuel Nozzles, by Prof. K. J. DeJuhasz, Penn State College.

Polyermization of Fuel Oils, by Gustav Egloff, Universal Oil Products Company.

Oil Engine Power Cost Report for 1936, by H. C. Major, Chairman of the Oil Engine Power Cost Subcommittee.

Waste Heat Recovery from Diesel Engines, by Glenn C. Boyer, Burns & McDonnell Engineering Company.

Symposium on Operating Problems with prepared statements by leading operators.

Correlation of Laboratory Tests on Fuel Oils with Field Operations, by W. F. Joachim, U. S. Naval Experiment Station, Annapolis, Md.

Recent Developments in Automotive-Type Diesel Engines, by O. D. Treiber, Hercules Motors Corporation.

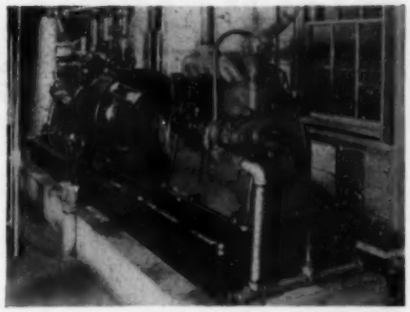
Some Operating and Upkeep Costs for Diesel Locomotives, by J. W. Anderson, Consulting Engineer.

This program shows evidence of careful planning on the part of the Papers Committee and will appeal to Diesel engineers as promising an active technical session.

## OIL-ENGINED LINERS

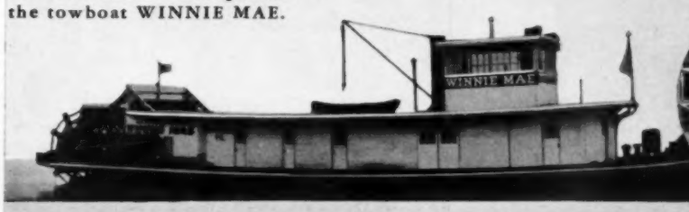
THERE are now about 20 big oil-engined passenger liners under construction, the number of which, according to *The Motor Ship*, is considerably in excess of that of corresponding steamers; even in the largest sizes, oil-engine propulsion is being employed substantially more than steam machinery, and ten of the motor ships are of between 18,000 tons gross and 28,000 tons gross, with machinery ranging from 12,000 hp. to 32,000 hp. The largest motor liners being built in England are for the Union-Castle Mail Steamship Co., and the Shaw, Savill and Albion Line, respectively, each being of about 26,500 tons gross.

## HERCULES DIESEL AT CANTON, MASS.

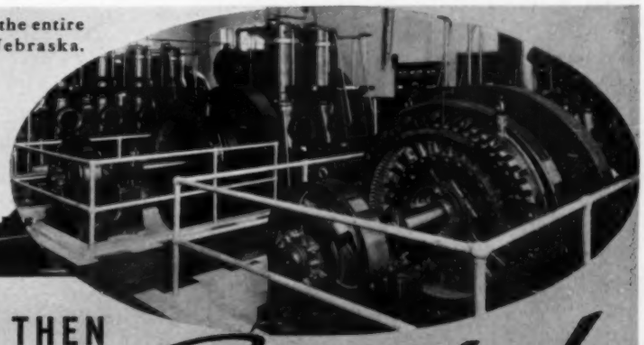


THE installation of a 50 kw. automatic Hercules Diesel electric generating plant in the factory of H. Schindler & Company, Canton, Mass., has proved highly successful, according to the Thermal Engineering Company, which made the installation. The plant consists of a double-ended, 1,200-rpm., 220-volt, 3-phase, 60-cycle generator driven by two DJXB, 3½ x 4½ 6-cylinder Hercules Diesel engines. These engines are operated automatically by a techomatic control furnished by the Thermal Engineering Company of Boston. It is so arranged that one engine runs continuously with the second engine cutting in and out automatically as the load increases or decreases. This is believed to be the first automatic Diesel generating plant to be installed in any factory.


An F-M Model 37 Diesel powers the towboat WINNIE MAE.




Three F-M Diesels power the entire town of Sutherland, Nebraska.



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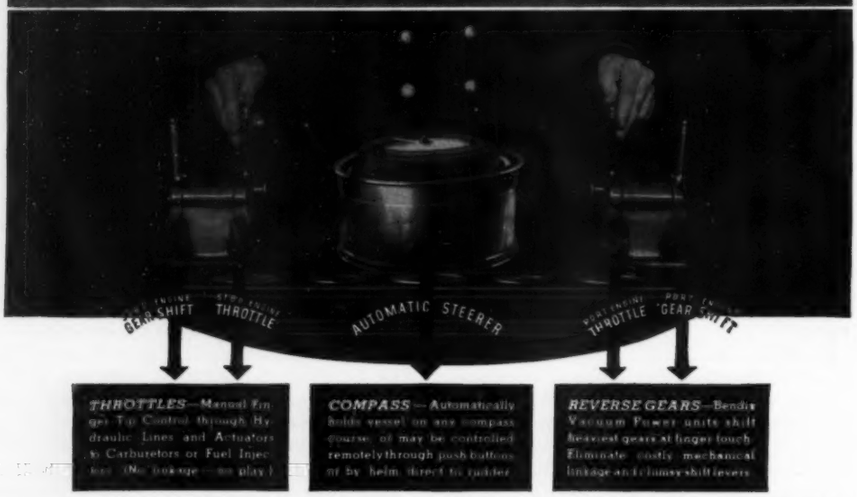


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## S.A.E. NEWS

EFFECT of a given change in atmospheric pressure or temperature on Diesel engine power is small with a low fuel-air ratio and increases as fuel-air ratio increases. At a constant fuel-air ratio, performance varies in a manner generally similar to that of the Otto-cycle engine. So concludes C. Fayette Taylor, M.I.T. professor and engine expert, in the July *SAE Journal*, published by the Society of Automotive Engineers. Taylor was in charge of the U.S. Navy aeronautical engine laboratory during the World War and in 1931 lectured to Japanese Naval officers and civilian engineers on aircraft engine design at request of the Imperial Japanese Navy. His July *SAE Journal* article is titled "Correcting Diesel Engine Performance to Standard Atmospheric Conditions."

• • • • •

Diesels will be prominent at the SAE Regional Fuels and Lubricants Meeting scheduled for Tulsa, Sept. 30 and Oct. 1. C. L. Cummins is expected to open the two-day session with a paper on recent Diesel engine development and Diesel fuels will be treated by Robert Best of Continental Oil on the morning of the second day.

Then the wind-up following the dinner on the evening of the second day will be a full-fledged formal debate on the subject, "Diesel vs. Gasoline Engines for Automotive Power Applications." Protagonists will be student debaters from the University of Oklahoma and from Tulsa University.

• • • • •

The Tulsa meeting offers several other discussions of real interest to Diesel men. New data in connection with the Hesselman engine will be revealed by a Waukesha representative; George Oberfell of Phillips will talk about gasoline volatility; and former SAE vice-president Fred M. Young will discuss engine cooling problems. Other papers projected include one on truck operations in the oil fields by A. W. Herrington; on motorcoach operations by Floyd Petras; and on aviation problems by Mac Short of Stearman Aircraft. SAE General Manager John A. C. Warner will discuss the Society's program in fuels and lubricants and allied fields and his remarks will be supplemented by SAE Research Manager C. B. Veal.

• • • • •

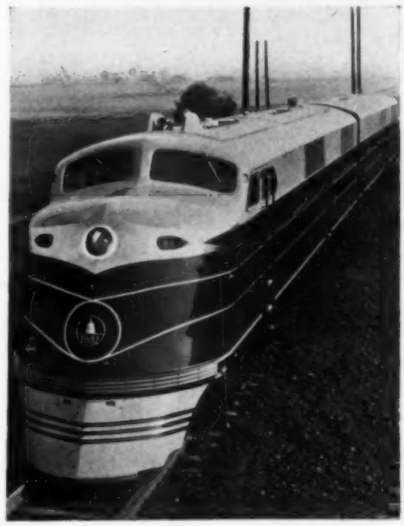
The Diesel Activity has asked the meetings committee for two exclusive Diesel sessions at the 1938 annual meeting of the Society, scheduled for next January. The location of the meeting has not yet been finally determined.

# COAST TO COAST VIA DIESEL STREAMLINERS

THE North American Continent is now spanned by regular Diesel-powered train service, it was announced by H. L. Hamilton, president of Electro-Motive Corporation, subsidiary of General Motors.

The closing of the last link in transcontinental Diesel-powered train service was made possible with the completion for the Baltimore and Ohio Railroad at the EMC plant at LaGrange, Ill., of a 3,600 hp. Winton Diesel locomotive. It is one of two like units for service on the *Capitol Limited* between Washington and Chicago on the Baltimore and Ohio railroad.

With this new locomotive in service it is possible to travel from Washington to the Pacific Coast entirely by Diesel train in 54 hours and 10 minutes running time. Four trains powered by Electro-Motive locomotives are already in operation from Chicago to the Pacific Coast. They are the *City of Portland* to Portland, Ore.; the *City of Los Angeles* to Los Angeles; the *City of San Francisco* to San Francisco; and the *Super-Chief* to Los Angeles. The first three named are operated by the Northwestern and Union Pacific Railroads, and the *Super-Chief* by the Sante Fe. The engines in all of these locomotives are Winton Diesels manufactured by the Winton Engine Corporation of Cleveland, Ohio, another subsidiary of General Motors.



*Quarter view of the first of two 3,600 hp. Winton Diesel locomotives recently delivered to the Baltimore & Ohio R. R. for the Capital Limited.*

Operation of these trains, with the addition of the *Capitol Limiteds*, will bring the total average daily mileage in regular service of Electro-Motive Diesel trains to 13,000 miles. Some of the trains travel as much as 33,000 miles a month. Some of the locomotives travel as far as 1,048 miles a day every day.

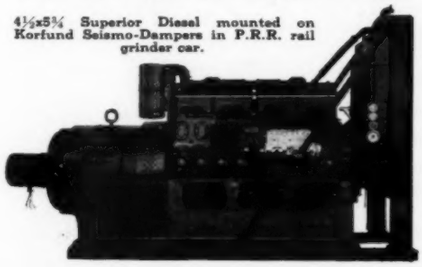
Each of the 3,600 hp. streamlined locomotives built for the Baltimore and Ohio Railroad is composed of two 1,800 hp. units coupled for multiple-unit operation from a single control station in the cab of the leading unit. The motive power for the 1,800 hp. units is identical and consists of two 900 hp. Winton Diesel power plants controlled simultaneously from the main locomotive throttle. The total weight of the locomotives, with full fuel supply, water and sand, approximates 569,000 pounds.


## SUPERIOR eliminates vibration troubles with KORFUND

TO insure satisfactory performance many Diesel manufacturers utilize KORFUND Anti-Vibration Products in their installations. Prominent among them is the National Supply Co. of Delaware, manufacturers of the famous line of SUPERIOR Diesels. This company has found KORFUND Products of essential value in a wide variety of installations.

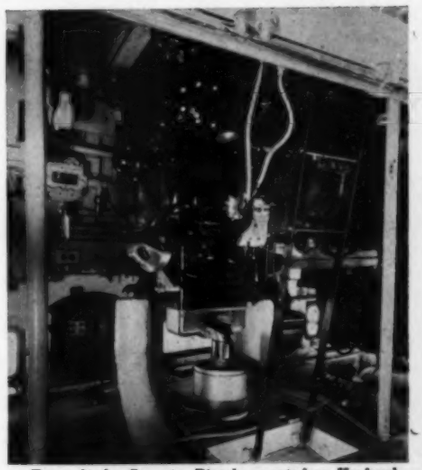
For instance, to effectively dampen the mechanical noises from engines mounted on a steel frame in a rail grinder car built for the Pennsylvania R. R. Co., two of the 4½x5¾ straight eight SUPERIOR Diesels shown below, connected to 60 KW alternating current generators were mounted on KORFUND Natural Cork Seismo-Dampers. Otherwise the steel frame would have amplified engine noises with objectionable results.

4½x5¾ Superior Diesel mounted on Korfund Seismo-Dampers in P.R.R. rail grinder car.



To the right is shown a two cylinder SUPERIOR Diesel mounted on KORFUND Steel Spring Vibro-Dampers in a large yacht. The National Supply Co. writes, "KORFUND Vibro-Dampers are practically essential on a two cylinder engine on a yacht and in every case we have had very good success in preventing the transfer of engine vibrations to any part of the boat."

We urge Diesel manufacturers and others interested to write us about their vibration problems and to send the coupon below for our informative brochure, ISOLATION.



Two cylinder Superior Diesel mounted on Korfund Vibro-Dampers in a large yacht

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## National Forge and Ordnance Company

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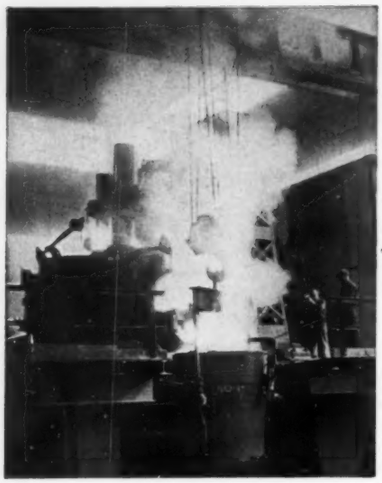

All National Forge and Ordnance Company products are manufactured from fine quality Basic Electric Steel.

Complete control of all processing from selection of the melting charge to the finished condition is National Forge and Ordnance Company's guarantee for maintenance of quality in crankshafts and various other types of forgings furnished to leading manufacturers in the Diesel industry.

**BASIC ELECTRIC STEEL FORGINGS**

**Carbon, Alloy, Corrosion Resistant and Special Steels Smooth Forged, Hollow Bored, Rough or Finished Machined, Heat Treated to Specifications. . . Forging Quality Ingots Pressed or Hammered Billets.**

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**PRODUCE ECONOMICAL POWER**

● BUT — To do this year in and year out with a minimum of attention, a minimum of repair expense and to give reliable power is something else.

Such dependable and trouble-free service is built in Buckeye Diesels. Their smooth steady operation is a result of their conservative design and construction.

Let us tell you more about these outstanding Diesels and how they make for greater economy through longer engine life and lower maintenance costs.

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*Sizes 40 hp. up to 600 hp.*

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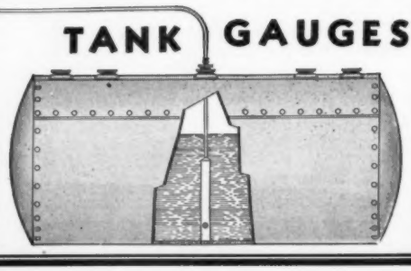

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## TURBULENCE IN TWO-CYCLE DIESEL ENGINES

. . . . *Continued from page 39* . . . .

In uni-flow engines, on the other hand, this dilemma does not exist. The hot, burning gases leave through ports near the cylinder head; hence the downward moving piston, being relieved from excessive heat, will cool off appreciably and the inrushing stream of comparatively cool air will reduce the temperature of the piston-head to a great extent.

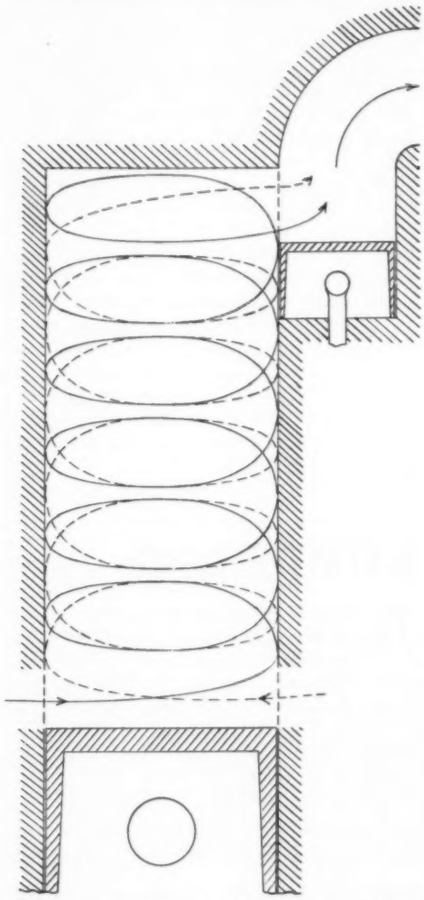

*Fig. 9. Air-spirals in test-cylinder, uni-flow 2 cycle engine.*

Painstaking research has proved that in a uni-flow engine with properly designed intake ports – not merely the customary slots of a shape dictated by a desire for ease in machining – the maximum of turbulence may be obtained, and in addition, pistons may be cooled adequately by a well directed air-stream. The


FOR THE OIL GASOLINE & WATER CONNECTIONS

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**VELLUMOID not only makes tight connections but connections which stay tight permanently. Cut or tap out gaskets as you need them from Sheet VELLUMOID—and be sure you get genuine VELLUMOID, not some substitute.**

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extent of such cooling may best be appreciated when it is said that pistons of a diameter ordinarily requiring oil-cooling may be operated successfully without any cooling being provided for; and extra large pistons, for which under ordinary circumstances water-cooling would be imperative, could effectively be cooled by oil. This, then, shows what can be accomplished by thoughtful design.

Piston overheating has been the Achilles-heel of many a 2 stroke cycle engine, not merely because pistons in such engines are subjected to twice as many power impulses as 4 stroke cycle engines, and hence greater heat, but mainly because heat has been allowed to be concentrated upon pistons, and no great effort has been made towards "natural" cooling of the piston-head, first, by directing useless heat away from the piston, and second, by providing efficient air-cooling for the piston-head.

The slow-speed 2 cycle engine may readily compete with slow-speed 4 cycle engines, but successful competition with high-speed 4 cycle engines is possible only with high-speed, high performance 2 cycle engines. And such engines must be so designed that complicated external means of piston cooling, either by means of oil or water, are obviated. Heavy, cumbersome pistons preclude the attainment of high-speed performance, yet, high speed is the yardstick with which modern engines are measured.

## OMISSION

AT the request of Mr. S. Rosenzweig, author of the interesting article entitled, "Diesel Engine Vibration Control," which appeared in DIESEL PROGRESS for April, 1937, we are pleased to give the following credit which was unintentionally omitted at that time:

The development of the curves appearing as Figure 5 on page 47 of the above mentioned issue and the mathematical calculations upon which these were based were made by Mr. H. Hartz, physicist in the office of Mr. Werner Genest of Berlin, Germany.

## CHANGE IN ADDRESS

WE are pleased to advise the readers of DIESEL PROGRESS that, on and after June 15th, the address of Diesel Plant Specialties Company will be 510 North Dearborn Street, Chicago, Illinois. The former address was 140 West Hubbard Street, also in Chicago.


**50 KW 3/60/240 F-M-32-VA DIESEL SET**

Practically new, fully guaranteed, complete with panel, volt. reg., motor driven clr. pump, engine air compressor, two bottles. Biggest bargain in America. $2,500 cash. Alao 20 kw. Caterpillar D-4400 set $2,000, and 30 kw. Caterpillar D-6600 set $2,500, new, used five days during recent Ohio River flood emergency.

**Power Equipment Co., Birmingham, Ala.**



**PROPELLED BY FAIRBANKS-MORSE DIESELS**
**PROTECTED BY MAXIM SPARK ARRESTING SILENCERS**

The Model SC2 Spark Arresting Exaust Silencers installed on the Diesel ferry, 'NORFOLK COUNTY,' in addition to effectively reducing the exaust noise, give positive assurance that no sparks or carbon will be thrown out on deck.

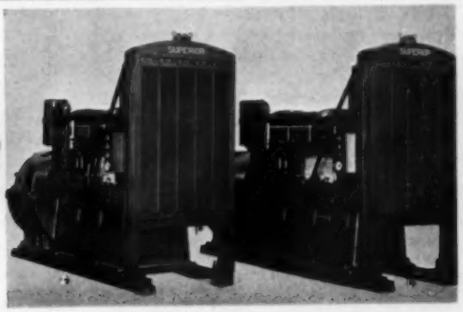
THE MODEL SC2 IS APPROVED BY THE U.S. DEPARTMENT OF COMMERCE, BUREAU OF MARINE INSPECTION AND NAVIGATION.

*Write for descriptive bulletin D-8*

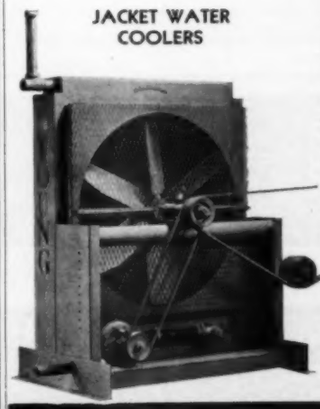
**THE MAXIM SILENCER COMPANY**
HARTFORD, CONN. 50 CHURCH STREET, NEW YORK CITY



OIL COOLERS



JACKET WATER COOLERS



**YOUNG COOLING SURFACE**

● Development of cooling equipment for Jacket Water and Oil has kept pace with the great increase in the uses of Diesel Engines, for all types of power applications. The Young Research Laboratories have been working for several years compiling data and making tests on new cooling units, with the result, that a Young Unit is available for any specific cooling job which you may have to perform. Each unit has been carefully developed and is based on exhaustive tests as well as a wealth of field experience.

*Write for Descriptive Literature*

**YOUNG RADIATOR COMPANY**
RACINE • WISCONSIN
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Young Quality

# 3 famous trains west

There are only four all-first-class solid-Pullman trains between Chicago and California. Three of the four are Santa Fe trains—following the shortest route, running over the only line under single management all the way, maintaining traditions of fine service that reach back for half a century.

**THE New SUPER CHIEF**

A new Super Chief—new from headlight to tailsign—has replaced Santa Fe's first Super Chief, that first inaugurated 39¾ hour service between Chicago and Los Angeles. The new train is of stainless steel, streamlined, Diesel drawn, air-conditioned. It leaves Chicago Tuesday evening, Los Angeles Friday evening. Extra fare is $10.

**THE CHIEF**

The Chief is without competition in its field. For years it has been the finest, the fastest by many hours, and the only extra fare *daily* train between Chicago and California.

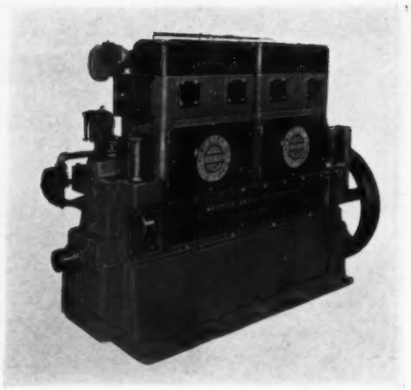
**CALIFORNIA LIMITED**

Third in the Santa Fe trio of all-Pullman California trains is the daily California Limited, known to transcontinental travelers for over forty years, and without extra fare.

It scarcely needs saying that these fine trains are air-conditioned, with Fred Harvey dining car service.

Santa Fe

W. J. BLACK, P.T.M.
Santa Fe System Lines
Railway Exchange Building
Chicago, Illinois

**GOLDEN ANNIVERSARY**

As an important step in celebrating its golden anniversary, the Western Engine Corporation of Los Angeles announces production of two new "Western" Diesel engines. They are smaller units and will be valuable additions to the already well known line of heavy duty Western engines.

Western Engine Corporation is the new corporate structure of the former Western Enterprise Engine Company, the oldest and largest builders of Diesel, gas and gasoline engines on the Pacific Coast. The business was established in 1887 and the new management headed by Henry D. Dargert, president and general manager, are already taking steps to properly commemorate fifty years of engine and machinery production.

The two new types that are added to the world known Western line of heavy duty engines places the corporation in a particularly attractive position to fill the varied requirements of the industrial and marine fields. A complete range from 20 hp. to 1000 hp. are now available. In addition, the general line of mining and contractors' hoists will be supplemented.

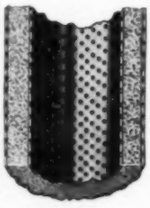

FARREL
GEARS · GEAR UNITS
GEARFLEX COUPLINGS
for Marine and Industrial Service
FARREL BIRMINGHAM COMPANY, INC.
285 Vulcan St., Buffalo, N. Y.

WAUKESHA-RICARDO
Diesel Engines
•
WAUKESHA-HESSELMAN
Oil Engines

# BURGESS MUFFLERS

There is no more restriction to gas flow through Burgess mufflers than through a straight pipe of equal size. These mufflers have no baffles to increase back pressure and lower engine efficiency. Yet they effectively silence low and high pitched noises.

**This patented sound absorbing principle makes it possible**



High pitched noises are effectively blotted up in Burgess mufflers by a patented lining, which consists of a perforated metal facing backed by an efficient sound absorbent. Low pitched noises are suppressed by reactance chambers. To obtain equivalent silencing, competitive mufflers utilize baffles and additional reactance chambers, thus increasing the back pressure and raising the cost, weight, and size of the unit.

Burgess offers a complete line of mufflers, intake silencers, and air cleaners for Diesel engines, of interest to every design, consulting and operating engineer. Write for bulletins.

Burgess Battery Co., Acoustic Div.
111 W. Monroe St., Dept. DPR
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BURGESS ACOUSTIC
AIR CLEANERS AND SILENCERS, BREATHER CAPS, MUFFLERS, ENGINE HOODS, FAB TREATMENT, AND VENTILATION SYSTEMS

Licensed under C. F. Burgess Laboratories, Inc., Patents

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(Remote Reading)
For use on Diesel operated ships, cranes, locomotives, municipal and private power plants
THE LIQUIDOMETER CORPORATION
LONG ISLAND CITY, N. Y.

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Dependable air compressors are vitally important for starting Diesel engines.
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DIESEL PROGRESS

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WE now have but thirty-five copies of the *Standard Practices* left on hand. This book has enjoyed a remarkable sale. It was published by the Diesel Engine Manufacturers Association late last year and has become the bible of the consulting engineer, Diesel salesman and prospective Diesel engine user.

And logically so, it contains a mass of vital information pertaining to standard performances, equipment and definitions. The cost of Diesel power. The selection of engine sizes for a given load. Power plant buildings. Engine construction. Governors and speed regulation. Erection data. Fuel oil storage and handling. Lube oil systems. Cooling water systems, etc., etc. Everything you need to know on Standard Practices – and the price of this unique books is but TWO DOLLARS. Subject to the supply now on hand we offer our readers this book – and heartily recommend it to them.

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# NEW DIESEL-POWERED SPORT FISHING BOAT IS FASTEST IN SAN DIEGO FLEET

THE *Star Angler*, powered by twin 120 hp., 6-cylinder Fairbanks-Morse Diesel engines, is the fastest of the more than twenty sport fishing boats operating out of San Diego, Calif. During the past deep-sea sport fishing season, this ultra modern vessel was in great demand because of its capacity to carry 55 fishermen and its speed of 11½ knots.

It is one of four sport angling boats owned and operated by the Star and Crescent Boat Co., three of which are powered by Fairbanks-Morse Diesels. The *Star Angler* has a length of 65 ft., beam of 16½ ft., depth of 8 ft. and draft of 5 ft. Electricity for lighting and for auxiliary service is provided by a Diesel-driven 5 kw. generator. 3 hp. motors drive the bait pumps that constantly change the ocean water in the bait tanks, keeping about 50,000 sardines alive.

The *Star Angler* has long, graceful lines, yet considerable width of stern. In accordance with modern design for such boats to provide the maximum casting area for anglers, most of the accommodations are below deck. These include: salon cabin with fully equipped lunch counter, galley, two berths and leather-covered settees. A club cabin forward of the pilot house has a table and several berths. The main live bait tank is in the stern and the two auxiliary tanks are on either side of the pilot house. Chromium steel rod rests, placed at intervals of 2 ft. around the entire fishing rail, are a feature of the boat. Since the pilot house, flanked on either side by rest rooms, is the only super-structure extending more than two feet above the deck, anglers enjoy a large, free casting area.

Deep sea sport fishing around the Coronado Islands, Mexico, 18 miles southwest of San Diego harbor, has become exceedingly popular during the past four years. Daily trips of vessels from San Diego to this, one of the greatest fishing banks in North America, draw fishermen from all parts of Southern California and Arizona, and many from greater distances.

**This Is the Duplex Fuel Oil Filter**

**Two of the World's Largest Diesel Locomotives**
**Santa Fe "Super Chief" and B. & O. "Capitol Limited"**
***are using***

**NUGENT** (Fuel and Lube) **OIL FILTERS**

**This Is the Lubricating Oil Filter**

Both the *Super Chief* and *Capitol Limited* will be assured economy and dependability for eight 900 hp. Winton Diesel engines because they are Nugent equipped.

**NUGENT OIL FILTERS**
have extra large filtering areas (patented) and employ the most scientific method of extracting the fine erosives, grit, sludge and carbon with the least amount of labor and least amount of space occupied.

**Wm. W. Nugent & Co., Inc. Mfrs.**
Oil Filters, Oiling and Filtering Systems, Telescopic Oilers, Oiling Devices, Sight Feed Valves, Flow Indicators, Compression Union Fittings, Oil Pumps, Etc.
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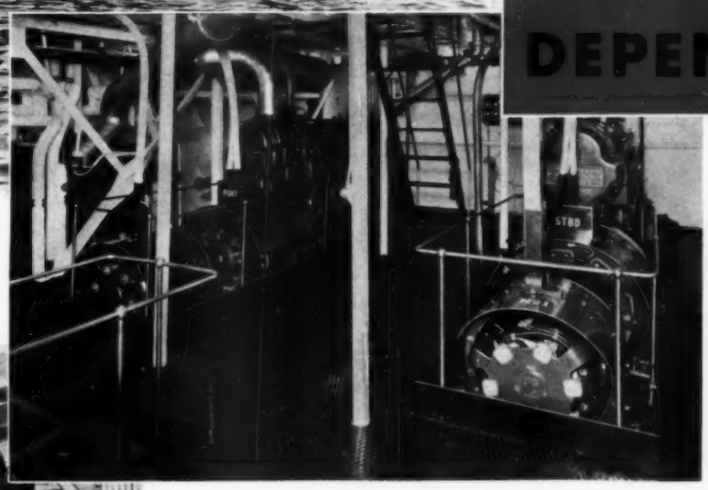
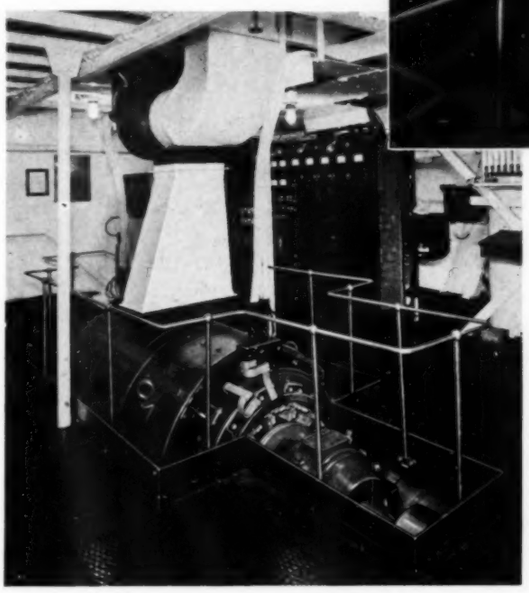
# Afloat or ashore—the same ELLIOTT smooth-running DEPENDABILITY!



On the "NORFOLK COUNTY," two 8-cylinder Fairbanks-Morse engines drive Elliott 250-kw., 1200-rpm. generators with direct-connected exciters.



The propulsion motor is an Elliott 600-hp., 180-rpm. double-armature unit. Elliott also furnished the switchboard and control.

THE ELECTRICAL EQUIPMENT on board the new Diesel ferry *Norfolk County* is Elliott. And the regular schedule of a ferry puts a premium upon dependability.

Elliott generators and motors in marine service include many units in United States submarines. A large percentage of the electrical equipment for submarine vessels built during the past 20 years has been of Elliott manufacture. Which again speaks volumes for dependability and engineering authority.

You can be sure Elliott generators for your Diesel engines will be built with the accent on performance. They will be designed exactly to the requirements of your Diesel engine and the peculiar characteristics of the installation. They combine high efficiency with rugged construction, conservative proportions, and perfect balance to produce the most reliable service.

Elliott "designed-to-the-job" generators for Diesel engines are made in a complete range of sizes and types.

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*District Offices in Principal Cities*

## ELLIOTT GENERATORS *for Diesel Engines*

# *Your* POWER COSTS ... *are they* LOW?

Think this over when you get your next engine bid: Cooper-Bessemer Diesels are *"economy champions!"* There's no better proof of this than the records of the many well-known workboats (Cooper-Bessemer powered) that travel the inland waterways. It's a *fact* that Cooper-Bessemer Diesels do *more* than offer you merely "Diesel" economy; instead, they give you *Cooper-Bessemer* economy . . . the result of 104 years of continuous research.

"WHITE CASTLE" — Built for Capt. Alex Barker by Nashville Bridge Company, this Louisiana tow-boat (76' x 18½' x 6½') is powered with a 350-H. P. Type JT-6 Cooper-Bessemer Diesel. *Service* — towing barges in Intra-coastal Canal.

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